PRELIMINARY INSTRUCTION MANUAL

D-16

[redacted]

Type 1026 STANDARD-SIGNAL GENERATOR

Form 1026-0100-A
ID B100
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Section 1 INTRODUCTION
Section 2 INSTALLATION
Section 3 OPERATING PROCEDURE
Section 4 PRINCIPLES OF OPERATION

SPECIFICATIONS

FREQUENCY

Range: 9.5 to 500 MHz in 6 ranges: 9.5 to 22, 22 to 48, 48 to 108, 108 to 220, 220 to 420, and 400 to 500 MHz.

Manual Control: Main frequency control, spinner knob with 100-division vernier dial (25 turns per range) drives main drum-type dial. Illuminated scale indicates selected range. Parallax-free fiducial mark is adjustable for fine calibration. Scales to 108 MHz are linear. An uncalibrated Δf control spans typically $\pm 0.003\%$ at low end of range to $\pm 0.015\%$ at high end (actual spans may vary 2:1 depending on frequency range).

Scale Characteristics:

Frequency Range (MHz)	*Main Scale Interval*	*kHz per Vernier Division*	*Scale Length (in)*
9.5-22	100 kHz	5	14¼
21.2-49.6	200 kHz	11	14¼
47.4-111	500 kHz	25	14¼
100-220	1.0 MHz	45-60	13
216-430	2.0 MHz	80-150	10½
400-500	2.0 MHz	150	4

External Electrical Fine Frequency Control: Applied voltage of ± 20 V dc varies frequency typically $\pm 0.04\%$ at low end of range to $\pm 0.2\%$ at high end (actual variation may differ by 2:1 depending on frequency range).

Calibration Accuracy: $\pm 0.5\%$ direct reading, after initial adjustment of fiducial. With internal crystal calibrator, $\pm 0.01\%$ at 1.0-MHz intervals, typically $\pm 0.05\%$ by interpolation.

Calibration Provisions: Internal crystal frequency, accurate to $\pm 0.001\%$, provides calibration at intervals of 1 and 5 MHz over entire frequency range. Calibration by external counter provided for by output of about 0.1 to 1 V behind 50 Ω. When not needed, this output can be disabled with >100-dB isolation; external counter can be simultaneously disabled by a contact closure provided to eliminate interference from the counter's internal signals.

Harmonic Output: At least 30 dB below carrier.

RF OUTPUT

Range: CW, 0.1 μV to 10 V behind 50 Ω, ½ W into 50 Ω (−133 to + 27 dBm); modulated, 0.1 μV to 5 V behind 50 Ω (−133 to + 21 dBm). Load VSWR > 2.0 may restrict the max output available at some frequencies.

Control: Step attenuator, 140 dB in 10-dB steps, voltage and dBm calibration. Continuous interpolation with metered level control.

Meter Scales: 0.3 to 1.5 V, 1.0 to 5.0 V, and −13 to +1 dBm. Scale extensions (in red), for cw use only, to 10 V and to +7 dBm.

Accuracy: Metering, $\pm 5\%$ to 108 MHz; above 108 MHz, harmonics can add $\pm 3\%$ and rectifier characteristic can add $\pm 2\%$. Attenuator, $\pm 1\%$ (± 0.1 dB) per step; max accumulated error ± 0.5 dB.

RF Interference: Leakage has negligible effect on measurements of receiver sensitivity down to 0.1 μV.

Leveling: CW output is held at preset level to within $\pm 2\%$ (0.2 dB) up to 108 MHz and to within $\pm 5\%$ (0.5 dB) to 500 MHz as frequency is varied, including effects due to range switching. Effectiveness of leveling under modulated operation is a function of modulation mode and frequency.

Stability: At any given frequency, in cw operation or internal 1-kHz modulation mode, and after 2-hour warmup, output will typically remain constant within ± 0.0025 dB per minute, or ± 0.01 dB over any 15-min period. Also under these conditions, variation due to $\pm 10\%$ line-voltage fluctuation is $< \pm 0.005$ dB.

Effective Generator Impedance (at panel jack): 50 Ω resistive; VSWR is <1.02 with output attenuator set for 0 dBm or less. At higher outputs, source impedance viewed as Thévenin generator has a VSWR < 1.2.

MODULATION

Modes:

Amplitude Modulation is provided in four modes:

1. Internal 1 kHz. Modulation level adjustable 0 to > 95% and metered to within ±3% of reading ±2% of full scale. Envelope feedback provides leveling and holds distortion to < 1% at 50% modulation and < 3% at 80% modulation. Modulating frequency, 1 kHz ±0.5%; after 2-hour warmup stable to better than 0.1% over 8-hour period or for line-voltage variations of ±10%. 1 kHz signal available at MOD binding posts, about 2.5 V behind 100 kΩ.

2. External Audio. Response flat to dc, down < 3 dB at 20 kHz. Square-wave response 0 to 10 kHz; rise and fall times < 10 μs; overshoot < 10%; rampoff negligible. Modulation level is adjustable 0 to > 95% for dc to 5-kHz input, to > 50% at 20 kHz, and is metered to within ±5% of reading ±5% of full scale for sine-wave inputs from 20 Hz to 20 kHz. For 95% modulation < 3 V, peak required into 3 kΩ. Envelope feedback provides leveling and holds distortion at 50% modulation to < 1% up to 1 kHz, < 5% up to 10 kHz.

3. External Wide Band. Modulation level adjustable 0 to > 80%. Response flat to ± 3 dB for 50-Hz to 1.5-MHz inputs at carrier frequencies above 108 MHz. Average carrier is leveled and metered, but modulation depth and linearity should be monitored externally. For full modulation, about 0.6 to 3.5 V (depending on carrier frequency) is required into 3 kΩ.

4. External Pulse. Required input pulses, at least 10 V peak, positive going (max 30 V); repetition rate 500 Hz to 150 kHz; duration 1 to 300 μs (min 3 μs on 9.5- to 22-MHz range); max 50% duty ratio. Input impedance 3 kΩ. Output pulse, duration within ±0.5 μs of input; rise and fall times < 1 μs each on all ranges but 9.5 to 22 MHz (up to 3 μs); rampoff < 5%. On-off ratio > 30 dB and at max output setting of attenuator is typically > 40 dB. Peak amplitude of pulses is leveled and metered to within ±1 dB added to accuracy specified for cw leveling.

Incidental FM (accompanying a-m): < 1 ppm, peak, at 1 kHz, 50% a-m.

Residual FM: < 0.05 ppm, peak.

Residual A-M: At least 70 dB below carrier level in cw, internal 1 kHz and external audio modes.

GENERAL

Power Required: 105 to 125 or 200 to 250 V, 50 to 60 Hz, 90 W.

Terminals: RF and counter outputs are GR874 Coaxial Connectors, recessed and locking; for rapid conversion to other common types, use locking GR874 adaptors. Modulation connection is to front-panel binding posts and rear-panel multiterminal connector. Audio (BEAT) output from front-panel telephone jack. Electrical frequency control is through rear-mounted 12-pin connector.

Accessories Supplied: Type 874-R22LA Patch Cord (GR874 to GR874), phone plug, 12-pin connector plug, CAP-22 power cord, spare fuses, hardware for bench and rack mounting.

Mounting: Rack-bench cabinet.

Dimensions: (width x height x depth): Bench, 19 x 17¾ x 15¼ in (485 x 450 x 390 mm); rack, 19 x 17½ x 13 in (485 x 445 x 330 mm).

Weight: Net, 96 lb (44 kg); shipping (est), 180 lb (80 kg).

CAUTION

Do not apply any source of power in excess of 1/4-W to the RF OUTPUT connector; damage could occur to the attenuator.

SECTION 1

INTRODUCTION

1.1 PURPOSE.

This manual contains installation, operation, and instructions for the Type 1026 Standard Signal Generator, shown in Figure 1-1. The 1026 provides a stable source of frequencies in the range 9.5 to 500 MHz. Coverage is achieved in six bands with single-dial tuning (no trimmer adjustment) throughout the selected band. This feature, combined with automatic output levelling in each of its modulation modes, makes the 1026 a valuable instrument in alignment and testing of receivers, filters, amplifiers and attenuators.

1.2 DESCRIPTION.

1.2.1 GENERAL.

The Type 1026 Standard Signal Generator is able to achieve its wide range of output level and excellent modulation characteristics through stringent attention to the suppression of rf leakage and a frequency-compensated negative-feedback loop. Rf circuits are housed in a rigid, shielded casting with all input and output lines filtered. Envelope detection of the rf output, and the associated negative feedback loop, limit modulation distortion and automatically level carrier amplitude.

For convenience, the operating controls are grouped by function. A six-position rotary switch selects the desired frequency range while a single vernier dial permits continuous tuning over each band. Unambiguous frequency readout can be made on the large, 6-scale drum dial; only the scale of the selected band is illuminated. A fiducial control permits precision adjustment of the scale at any of a series of crystal-controlled check points.

Five modulation modes are available. These are cw, internal 1-kHz, and three external modulation modes – audio, wide-band and pulse. Percentage of modulation is adjustable from zero to at least 95%, as indicated by a panel meter, in the internal 1-kHz mode. In the external audio mode, 95% modulation is possible from dc to at least 5 kHz; at least 50% modulation is possible up to 20 kHz.

Rf power output is adjustable over a range of 160 dB in the cw mode and 154 dB modulated. The output level is indicated by a meter and controlled by a 15-position step attenuator calibrated in volts and dBm.

Frequency checking with the 1026 is accomplished either through use of an internal crystal calibrator or by connecting an external frequency meter to the FREQUENCY METER output connector. Electrical fine-frequency control permits phase-locked operation of the 1026 in conjunction with suitable accessory equipment. In addition, narrow-band frequency modulation of the rf output is obtainable with the 1026.

1.2.2 CONTROLS, INDICATORS AND CONNECTORS.

Table 1-1 lists the panel controls, indicators and connectors on the Type 1026 Standard Signal Generator, with separate columns for description and function data.

1.2.3 REAR-PANEL CONNECTORS AND FUSES.

Table 1-2 lists the Type 1026 Standard Signal Generator's rear panel connectors and fuses.

TABLE 1-1
PANEL CONTROLS, INDICATORS AND CONNECTORS

Figure 1-1 Ref.	Name	Description	Function
1	POWER	3-position rotary switch	Selects power OFF, STANDBY, ON
2	Indicator drum	Contains backlighted scales for 6 frequency bands	Frequency readout
3	FIDUCIAL ADJUST	Continuous rotary control	Permits precise adjustment of frequency scale at convenient checkpoints
4	FREQUENCY	25-turn vernier dial, calibrated 0-100	Main frequency control
5	FREQUENCY RANGE	6-position rotary switch, detented	Band selection
6	Meter	0.3 to 1.5 V, 1 to 5 V, and -13 to +1 dBm scales. Red scales cw only, 5 - 10 V and +1 to +7 dBm	Rf output-level indicator
7	CARRIER LEVEL	Potentiometer control	Sets reference to which internal feedback loop stabilizes output level
8	OUTPUT RANGE	15-step rotary attenuator; show-through dial calibrated in volts and dBm	Provides attenuation of rf output in 10-dB steps
9	RF OUTPUT	Type GR874 coaxial connector, Z_O = 50 Ω	Rf output
10	AUDIO GAIN	Potentiometer control	Adjusts level of audio from the crystal calibrator to the BEAT OUTPUT telephone jack.
11	BEAT OUTPUT	Telephone jack	Provides audio from beat of carrier against internal crystal-calibration oscillator
12	ΔF	Potentiometer	Fine frequency control, at approx ±0.003% at low end of bands, ±0.015% at high end
13	FREQUENCY CALIBRATOR	4-position rotary switch	Selects EXTERNAL, OFF, INT XTAL 1 MHz or INT XTAL 5 MHz modes of calibration
14	FREQUENCY METER	Type GR874 coaxial connector	Connection for frequency meter in EXTERNAL calibration mode
15	Modulation jacks	Binding post	Input connections for modulating signals in EXTERNAL AUDIO, EXTERNAL WIDE BAND and EXTERNAL PULSE modes. Output connection in INT 1 kHz mode
16	MODULATION SELECTOR	5-position rotary switch: show-through dial	Selects INTERNAL 1-kHz, CW, EXTERNAL AUDIO, EXTERNAL WIDE BAND or EXTERNAL PULSE modulation modes
17	MOD OFF/MODULATION LEVEL	Ganged switch and potentiometer control	Disables modulation or permits adjustment of 0-95% modulation in INTERNAL 1-kHz and EXTERNAL AUDIO modes
18	Meter	PERCENT scale 0-100	Indicates modulation percentage in INTERNAL 1-kHz and EXTERNAL AUDIO modes

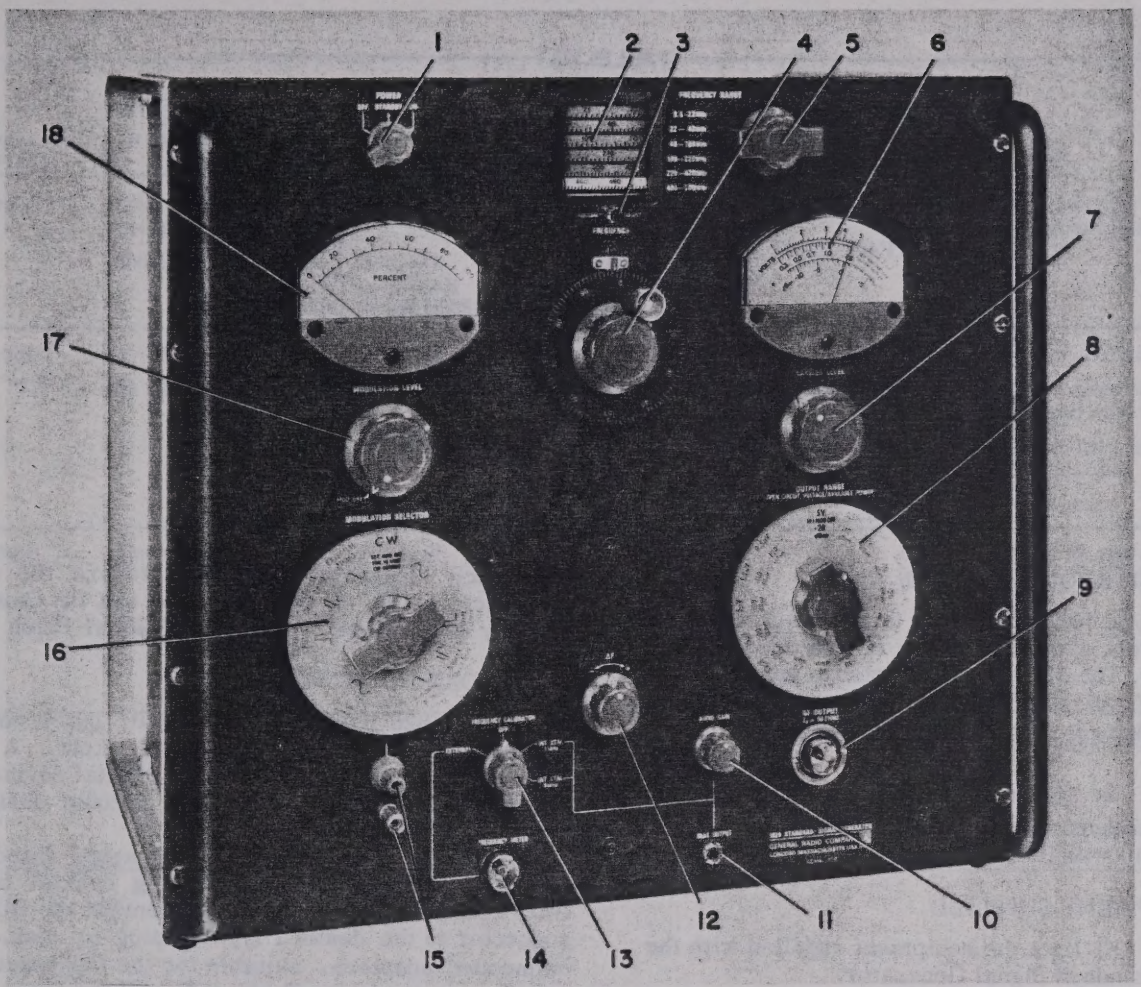

Figure 1-1. Panel View of the Type 1026 Standard Signal Generator (refer to Table 1-1).

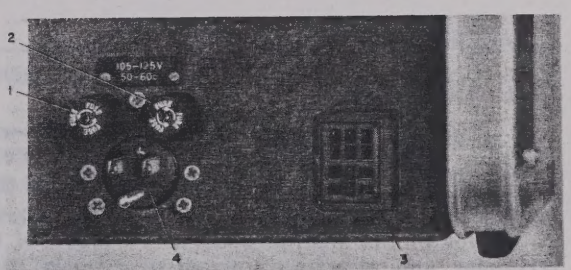

Figure 1-2. Rear view of the Type 1026 Standard Signal Generator (refer to Table 1-2).

TABLE 1-2
REAR-PANEL CONNECTORS AND FUSES

Figure 1-2 Ref.	*Name*	*Description*	*Function*
1, 2	F401, F402 (115 V)	1.6A, 3AG type, Slo-Blo	115-V input-line fuses
	F401, F402 (230 V)	0.8A, 3AG type, Slo-Blo	230-V input-line fuses
3	Remote connector	12-pin Jones connector	Connections for external fine-frequency control, fm operation, external frequency-counter control, and external modulation signal input. (see paragraph 2.4)
4	Power plug	3-prong ac connector	Connects line power to the instrument

TABLE 1-3
EQUIPMENT SUPPLIED

Item	Description	GR Part Number
Power cord	3-wire, 7-foot length	4200-9622
Phone plug	2-conductor	4220-2000
Fuses: F401, F402 (115 V)	Spare	5330-1700
(230 V)	Spare	5330-1200
Patch cord	Rf, Type 874-R22LA, coaxial, 3-foot	0874-9683
Support set	For rack-mount conversion	7863-9602
Multipoint connector plug	Mates with rear-panel remote connector, SO414	1026-1950

1.2.4 POWER REQUIREMENTS.

The Type 1026 generator is normally wired for operation from a power source of 105-125 V, 50-60 Hz, 90 watts. The 1026 can be adapted to operate from a 200-250-V, 50-60-Hz, 90-watt power source with the wiring changes described in paragraph 2.1.

NOTE

The 1026 should not be operated from a 400-Hz power source.

1.2.5 EQUIPMENT SUPPLIED.

Table 1-3 lists the equipment supplied with the Type 1026 Standard Signal Generator.

1.3 ACCESSORIES AVAILABLE.

1.3.1 GENERAL.

General Radio has available a well-rounded grouping of accessory instruments and devices to facilitate introduction of the output signal of the 1026 in most usual measurement systems, to ensure full utilization of the many versatile features of the instrument, and to permit convenient external monitoring of its performance. Instruments and devices that most readily fall into this category are listed or briefly described in paragraphs that follow.

1.3.2 EXTERNAL MODULATION SOURCES.

Table 1-4 lists (with pertinent characteristics) instruments recommended to meet the very wide range of signal-source requirements presented by the three external modulation modes of the 1026.

1.3.3 COUNTERS.

To make precision frequency settings on the 1026, a digital-reading frequency counter, attached to the FREQUENCY METER connector on the front panel, is valuable ancillary equipment. The GR Type 1143 Frequency Measuring Assembly covers the entire frequency range of the 1026 and can be connected directly with a Type 874-R22LA Coaxial Patch Cord.

1.3.4 COAXIAL ADAPTORS.

The 1026 uses the low-VSWR, quick-connect, GR874 coaxial connector for its rf output. A comprehensive assortment of special coaxial devices and instruments, based on the GR874 50-ohm design, is available to complement it.

For the user who has components fitted with coaxial connectors of other leading coaxial series, GR874 adaptors are available to convert the OUTPUT connector to the desired type of plug or jack. Recommended adaptors, suitable for the frequencies involved, are listed in Table 1-5. All the types listed here can be locked to the 1026 for a rigid installation and minimum rf leakage at that junction.

1.3.5 OTHER COAXIAL DEVICES.

Applications of the convenience and low-loss performance of GR874 coaxial devices, in rf measurement hook-ups with the 1026, are too extensive for coverage here. However, at least some of these devices are of general enough application to merit particular mention.

To apply a standard signal to more than one point in a test set up, thus taking advantage of the high output power of the 1026, use of the Type 874-TPDL Power Divider, singly or in cascade arrangement, is suggested. The 874-TPDL is a coaxial tee that, connected to the OUTPUT of the 1026, splits the input signal into two equal portions, each 6 dB below the input, matched within 0.3 dB, with zero phase difference.

To monitor the modulation envelope of the 1026 output on an oscilloscope, connect the Type 874-VQL Voltmeter Detector (a coaxial crystal detector that can be terminated with a Type 874-W50BL 50-ohm load) directly to the FREQUENCY METER connector.

The Type 274-NL Double-Plug Patch Cord, a 3-foot unit terminated with shielded binding-post pairs at each end, offers rapid interconnection for recommended modulators at the EXTERNAL MODULATOR jacks of the 1026.

TABLE 1-4

EXTERNAL MODULATORS AVAILABLE

Modulation Mode	1026 Characteristic Range	Recommended Accessories	Accessory Range	Remarks
External Pulse	10 - 30 V peak, positive going; 500 Hz to 150 kHz	GR 1398	2.5 Hz - 1.2 MHz	Use blocking capacitor between pulse generator and input of 1026
		GR 1217 (with 1201 Power Supply)	2.5 Hz -1.2 MHz	
External Wide-Band	0 - 10 V, p-p; 50 Hz - 1.5 MHz	GR 1310	2 Hz - 2 MHz sinewaves	For sinusoidal modulation
		GR 1395	2.5 Hz - 1.2 MHz (1395-P1)	Plug-in modules required depend on desired waveform
		GR 1396	0 - 500 kHz	For use with GR 1310 to generate tone-burst modulation
		GR 1390	5 Hz - 5 MHz	For noise modulation
External Audio	Sinewave: 0 - 3 V, peak; 0 - 20 kHz Square-wave; 0 - 10 kHz PRF; 10-µs rise time 10-µs fall time	GR 1309	10 Hz - 100 kHz	For low-distortion sinusoidal or square-wave modulation
FM		GR 1310 GR 1309	2 Hz to 2 MHz 10 Hz - 100 kHz	For sinusoidal modulation
		GR 1390		For noise modulation
		GR 1395	2.5 Hz - 1.2 MHz	Plug-in modules required depend on desired waveform

TABLE 1-5

GR874 LOCKING ADAPTORS TO OTHER SERIES

Mates	Type	Contains GR874 and ...	Connects GR874 to ...	Catalog Number
Type BNC	874-QBJL	BNC Jack	BNC Plug	0874-9701
Type C	874-QCJL	C Jack	C Plug	0874-9703
Type MICRODOT	874-QMDJL	Microdot Jack	Microdot Plug	0874-9721
Type N	874-QNJL	N Jack	N Plug	0874-9711
Type SC	874-QSCJL	SC Jack	SC Plug (Sandia)	0874-9713
Type TNC	874-QTNJL	TNC Jack	TNC Plug	0874-9717
GR900	900-Q874	GR900	GR900 Precision 14-mm connector	0900-9883
Type OSM*/BRM	874-QMMJL	OSM/BRM Jack	OSM/BRM Plug	0874-9723
AMPHENOL APC-7	874-QAP7L	APC-7	APC-7 Precision 7-mm connector	0874-9791

*Registered trademark of Omni Spectra, Inc.

These uniform 50-ohm adaptors offer electrical performance to match their convenience of use. A special low-VSWR design assures that the over-all VSWR of the converted GR874 connector is no greater than that of the other-series connector by itself (with the exception of the Type 900-Q874.

SECTION 2

INSTALLATION

2.1 POWER INPUT CONNECTION.

Using the power cord supplied, connect the 1026 to a source of power as specified by the small plate attached at the rear of the cabinet over the power-input plug and line fuses.

If the instrument must be adapted for operation from a 230-V ac source, refer to Table 1-2 for fuse data.

The conversion is accomplished by rearrangement of jumper leads between solder terminals on the top surface of the power-supply assembly. Wiring instructions appear on the etched-circuit board. The cabinet must be removed and input power disconnected.

Wiring of the power supply for 115-V operation is shown in Figure 2-1. Ten links are required between terminals. To convert to 230-V operation, remove all links required for 115-V operation, and reinstall five links as shown in Figure 2-2. The links should be installed as indicated in Table 2-1.

NOTE

The shock mounted power supply of the 1026 is secured by two screws to prevent jarring during shipment. These screws should be removed prior to use. The screws are accessible at the left side of the instrument (viewed from the front).

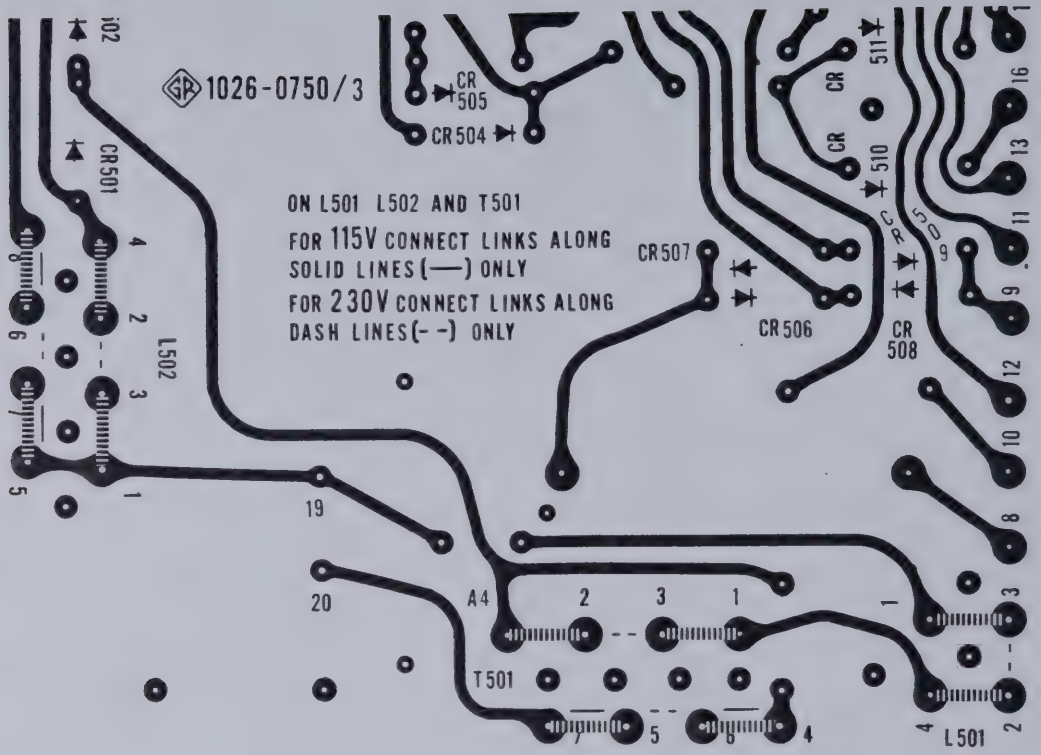

Figure 2-1. Detail view of Power Supply assembly, showing wire-link connections on top etched board for 115-V operation. Ten solder links are required.

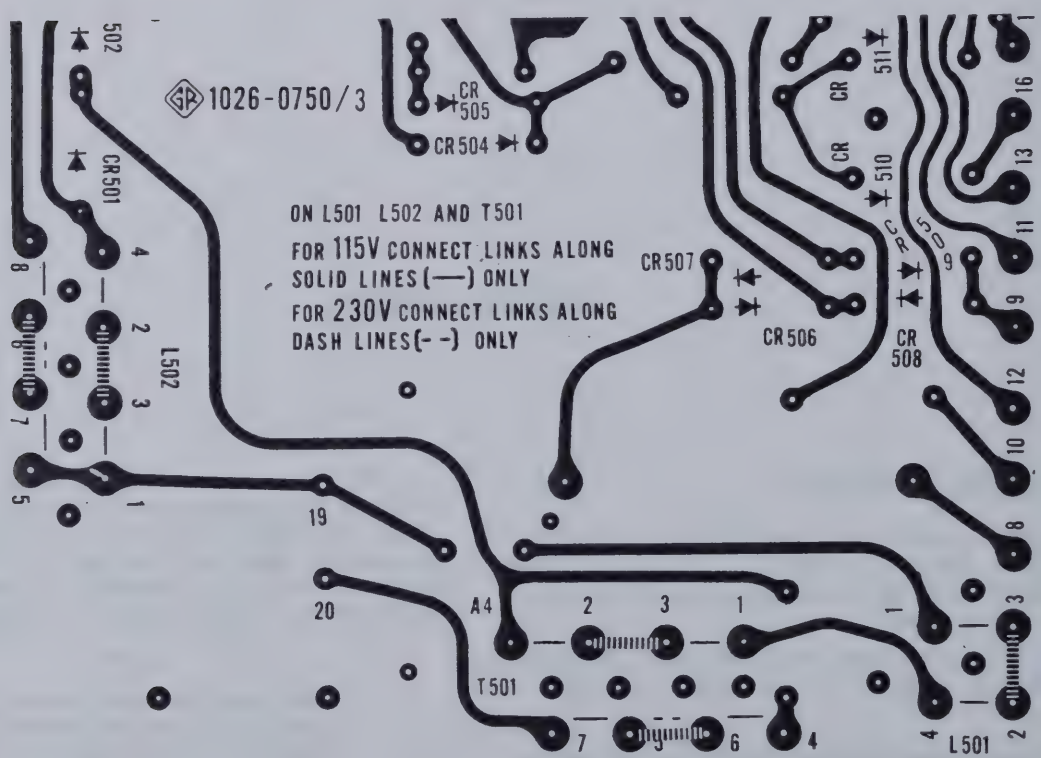

Figure 2-2. Detail view of Power Supply assembly, showing wire-link connections on top etched board for 230-V operation. Five solder links are required.

TABLE 2-1

POWER SUPPLY SOLDER LINK ARRANGEMENTS

Component	*115-V Connections*	*230-V Connections*
L501	connect 1 to 3 and 2 to 4	connect 2 to 3
L502	connect 1 to 3, 2 to 4, 5 to 7, and 6 to 8	connect 2 to 3 and 6 to 7
T501	connect 1 to 3, 2 to A4, 4 to 6, and 5 to 7	connect 2 to 3 and 5 to 6
F401, F402	Use 1.6A, 3 AG type Slo-Blo	use 0.8A, 3 AG type Slo-Blo

2.2 MOUNTING.

The 1026 Standard Signal Generator is supplied equipped for bench use, with aluminum end frames attached to the sides of the cabinet. Each frame is held in place by four panel screws and four 10-32 Phillips-head screws into the side of the cabinet. There are no special mounting requirements beyond the need for sufficient space to accommodate the dimensions of the 1026, shown in Figure 2-3.

For rack mounting, special brackets and a kit consisting of attaching hardware is supplied. Table 2-2 lists the contents of the kit. The brackets permit either cabinet or instrument to be withdrawn independently of each other. Figure 2-4 illustrates both bracket attachment and rack mounting.

To install the instrument in a relay rack:

a. Release the screws on the rear wall of the cabinet. Remove the cabinet from the instrument and the end frames from the cabinet.

NOTE

Power-supply shipping screws on left-side wall must also be removed.

b. Lay the cabinet on its left side (looking at it from the front) with the front-panel forward.

c. Place the right-side-rack support (A) on the right side of the cabinet. Be sure that the flange with the mounting holes is forward and flush with the front of the cabinet (see Figure 2-4) when the other flange (without holes) is resting against the bottom of the cabinet.

d. Assemble two pairs of flatwasher (D) and thumbscrew (E).

e. Install these as shown in the figure and tighten.

f. Turn the cabinet on its right side.

g. Place the left-side-rack support on the left side and align it in the same manner as the right side.

h. Repeat steps d and e for this side.

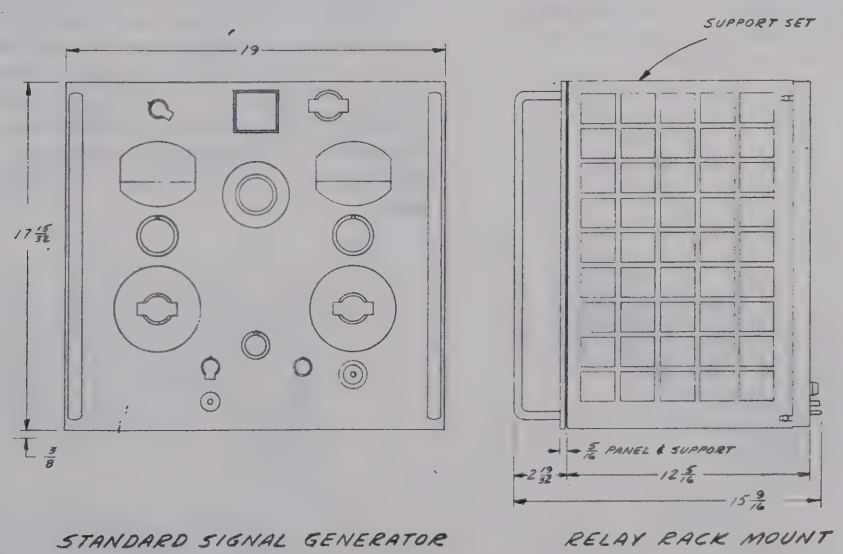

Figure 2-3. Dimension drawing for 1026.

TABLE 2-2

RACK-MOUNT KIT (P/N 7663-9602) CONTENTS
(INCLUDING HARDWARE SET P/N 7863-3002)

Quantity	*Description*	*Index See Figure 2-2*	*Part Number*
1	Rack-support Frame, left	A	7863-8792
1	Rack-support Frame, right	A	7863-8692
4	Screw, No. 10-32, slotted-head, 5/8 inch inch, steel	B	7160-0325
8	Panel screws, No. 10-32, Phillips-head 5/8 inch, nickel gray, with cupwasher	C	7270-6210
4	Flatwasher, No. 10, 1/16 inch thick	D	8100-1517
4	Thumbscrew, No. 10-32, 1/4 inch	E	7270-3800

i. Install the cabinet with supports into the desired rack position by use of the four No. 10-32 washerless screws (B). The flange holes to be used are second in from the extreme outside, at the top and bottom.

j. Reinstall the instrument in its cabinet and attach it to the rack with the Nylon-cupped screws (C).

NOTE

Omit the cabinet-to-chassis screws in the rear.

When the instrument is to be removed from the rack, remove the panel screws (C) and pull the instrument forward.

To remove the cabinet and leave the instrument mounted, loosen the thumbscrews (E) and slide the cabinet off, through the back of the rack.

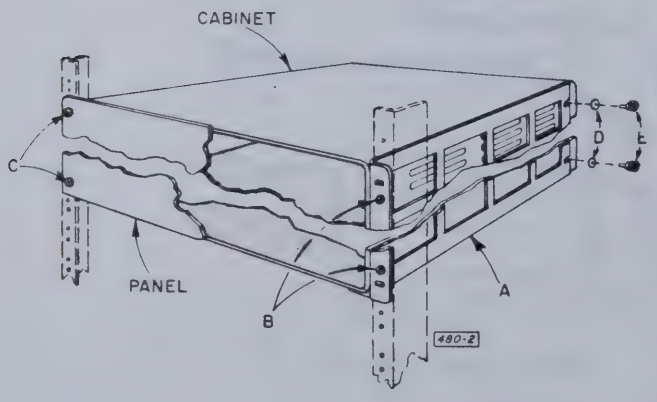

Figure 2-4. Relay rack mounting.

2.3 ENVIRONMENTAL CONSIDERATIONS.

The 1026 is intended for customary shop, laboratory and test-facility applications. The instrument should not be subjected to ambient temperatures outside the range 0-50° C in its operation. In addition, since the 1026 contains variable tuning capacitors, it should be afforded isolation from vibration to avoid microphonics.

2.4 REAR-PANEL CONTROL LINES.

Figure 2-5 illustrates pin assignments for the rear-panel remote connector SO414. By applying a suitable control voltage between pins 1 and 2, it is possible to produce the electrical fine-frequency control required for narrow-band frequency modulation or phase-lock operation. The ΔF potentiometer control is still operative in the presence of an external control voltage. The external voltage should be ±20 V, peak, from a source whose dc resistance is less than 600 Ω. The frequency deviation can be monitored externally by use of rf from the FREQUENCY METER jack.

NOTE

When not used for this function, pins 1 and 2 must be connected together, either by the special clip installed in the instrument as shipped, or by means of a jumper connection installed in the mating accessory plug supplied.

Pin 3 provides connection to the +30-V bus through a limiting resistor, while pins 11 and 12 may be used to supply the external-modulation signal to input jack J412. Pins 4, 5 and 6 may be used for external frequency-counter control in frequency-cali-

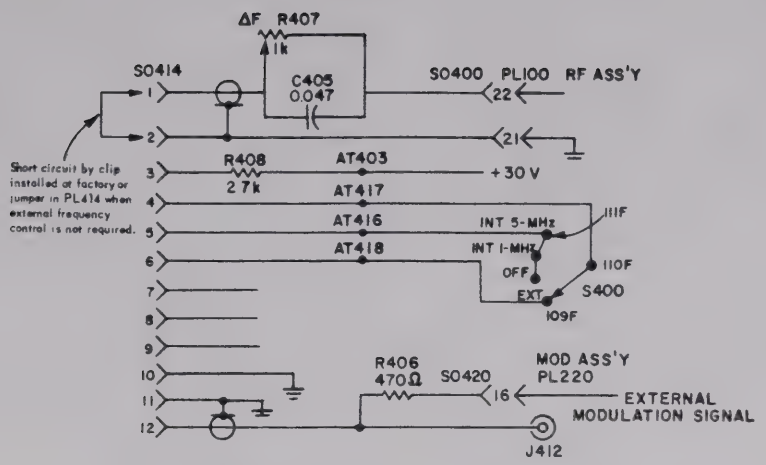

Figure 2-5. Wiring detail for S0414.

bration applications. Since some counter switching circuits radiate interference which can cause trouble in measurements on sensitive receivers, it may be desirable to disable these circuits when the counter is not actually in use. FREQUENCY CALIBRATOR switch S400 includes a single-pole, double-throw contact function to permit automatic control of the counter when switching from the EXTERNAL FREQUENCY METER to the OFF position. If the counter is to be disabled by opening a supply line, use pins 4 and 6; if it is to be disabled by short circuiting two points, use pins 4 and 5.

SECTION 3

OPERATING PROCEDURE

3.1 GENERAL.

Operation of the 1026 Standard Signal Generator is greatly facilitated by its single-dial tuning feature. Functional grouping of the controls further contributes to the ease with which frequencies are selected and calibrated, power levels are set, and modulation is applied.

3.2 TURN-ON.

To place the 1026 in operation, turn the POWER switch to the STANDBY position and allow a minute for the instrument's tube heaters to warm up. In STANDBY, the rf generation and amplification circuits are disabled while tube heaters are allowed to function, a feature that proves very useful during laboratory tests that require the rf to be disabled temporarily without having to reset the OUTPUT level or having to start a new warm-up cycle.

Next, place the POWER switch in the ON position. At this point, the instrument may be used for measurements not requiring a high order of frequency or output-level stability. For most measurements, a fifteen-minute warmup period is desirable; up to four hours warmup may be required in the case of very critical measurements that need the full specified stability of the 1026. Even after protracted warmup, the frequency drift immediately following band changing or retuning is significant for about five minutes.

3.3 FREQUENCY SELECTION.

To set up the frequency of the 1026's rf output, first select the proper band with the FREQUENCY RANGE switch; scale illumination indicates the band that has been selected. Rotate the FREQUENCY spinner knob until the desired frequency is indicated by the fiducial. Frequency selection performed in this manner is accurate to ±0.5%, providing the fiducial adjustment is near the center of its adjustment range, or has been set to be correct near the center of the band in use. For greater accuracy, use one of the instrument's calibration modes discussed in paragraph 3.4.

The frequency scale is linear on the three ranges covering up to 108 MHz; dial-scale characteristics are given in Table 3-1.

TABLE 3-1
SCALE CHARACTERISTICS

Frequency Range (MHz)	*Main Scale Interval*	*kHz per Vernier Division*
9.5 - 22	100 kHz	5
22 - 48	200 kHz	11
48 - 108	500 kHz	25
108 - 220	1.0 MHz	45 - 60
220 - 420	2.0 MHz	80 - 150
400 - 500	2.0 MHz	150

Frequently it is desirable to set or maintain a frequency closer to the desired value than is convenient when using the main tuning control. The ΔF control permits the very fine adjustment that may be desired to keep the signal generator in tune with the internal crystal calibrator or an external monitoring device.

To obtain electrical frequency control, for narrow-band frequency-modulation or phase-lock applications, connect an external control voltage between pins 1 and 2 (ground) of remote-control connector SO414, at the rear of the 1026. Refer to paragraph 2.4 for instructions on the use of SO414.

3.4 FREQUENCY CALIBRATION.

3.4.1 GENERAL.

When frequency-setting accuracy greater than ±0.5% afforded by the drum dial scales is required, either an external frequency meter or counter, or the internal crystal calibrator can be employed.

3.4.2 INTERPOLATION SETTINGS.

For the most accurate frequency settings between 1-MHz points interpolation is usually necessary, although at the lower carrier frequencies intermediate beats at 0.50, 0.33, and 0.25 MHz can be used. To interpolate, note the difference in setting of the FREQUENCY control for adjacent beats, using the 0 to 100 scale on the spinner knob. Tune upward from the beat just below the desired frequency by that proportion of the 1-MHz setting difference which is represented by the fraction of a megahertz desired.

For example, the difference between 150 and 151 MHz is found to be 56 dial divisions and the desired frequency is 150.2 MHz. Find the 150-MHz beat, and tune upward by 11.2 dial divisions (0.2 x 56 = 11.2). Accurate interpolation requires that all dial settings be approached from the same direction, in order to avoid effects of backlash that may amount to as much as 2 dial divisions. Repeatability when tuning in the same direction is approximately ten times better than when direction is reversed.

3.4.3 USE OF INTERNAL CRYSTAL CALIBRATOR.

Internal calibration can be accomplished in either of two INT XTAL modes, 1 MHz or 5 MHz. The 1-MHz mode should be used for preliminary fiducial adjustment at frequencies up to 108 MHz, the 5-MHz mode at higher frequencies.

To adjust the FIDUCIAL, set the FREQUENCY calibrator to the 1-MHz or 5-MHz mode (depending on carrier frequency), plug headphones into the BEAT OUTPUT telephone jack, and adjust the audio gain control for a comfortable level of beats. Avoid excessively high output-level settings which may bring weaker intermediate beats up to a level which could cause confusion. Tune the FREQUENCY spinner knob to a beat near the desired operating frequency. At frequencies above 220 MHz, it is desirable to choose a beat occurring at a multiple of 10 MHz, since such beats coincide with dial-scale markings. When a suitable low audio beat has been obtained, set the FIDUCIAL ADJUST to agree with the appropriate scale mark.

The 1-MHz position of the FREQUENCY calibrator is useful at even the highest carrier frequencies, once the preliminary adjustment of the FIDUCIAL has been completed. The signal generator can be set very precisely to any integral megahertz by starting from a 5 MHz multiple, and counting the 1-MHz beats while tuning the FREQUENCY control until the appropriate offset has been reached. There is normally no advantage to resetting the FIDUCIAL again, assuming it was set correctly at the 10-MHz check point.

3.4.4 USE OF EXTERNAL FREQUENCY METER.

Place the FREQUENCY CALIBRATOR switch in the EXTERNAL position to furnish a sample of 1026 rf output (0.1 to 1 V behind 50 Ω) to the FREQUENCY METER jack. A digital-counter type of frequency meter, connected to this jack, can be used to display directly the output frequency of the 1026. Upon completion of a frequency check, return the FREQUENCY CALIBRATOR switch to the OFF position, in order to prevent rf leakage from the cables and auxiliary apparatus connected to the FREQUENCY METER jack. When not in use, the FREQUENCY METER output is disabled with greater than 100-dB isolation. If residual radiation from the counter's scaling circuits is objectionable, these may also be disabled by means of contact closures of the FREQUENCY CALIBRATOR switch, which are brought out to remote-control connector SO414. Refer to paragraph 2.4 and to Figure 2-5 for details of SO414 wiring.

3.5 CARRIER-LEVEL SETTING.

Two controls and a meter indicator are used to control the level of rf power output of the 1026 Standard Signal Generator. With the MODULATION SELECTOR in the CW position, the level of RF OUTPUT is adjusted by the CARRIER LEVEL control (in conjunction with the OUTPUT RANGE switch); the level remains constant despite frequency range-switching and tuning.

The OUTPUT RANGE switch is a 15-step attenuator with dual calibration. Its outermost calibrations identify the maximum value of OPEN CIRCUIT VOLTAGE; these calibrations are used in conjunction with the meter's two voltage scales, 0.3 - 1.5 and 1 - 5. The inner dBm calibrations added algebraically to the meter's dB-scale indication, express AVAILABLE POWER at the RF OUTPUT; the incremental attenuation is 10 dB per step.

For example, with the OUTPUT RANGE selector set to the 15 mV position, the CARRIER LEVEL control can set an output between 3 and 15 mV, as indicated on the meter's 0.3 - 1.5 scale.

Up to 10 V (+27 dBm) output may be obtained in the unmodulated mode only. To achieve outputs above 5 V (+21 dBm), leave the OUTPUT RANGE selector set at the 5 V (10 V MOD OFF) position and set the MODULATION LEVEL control fully counterclockwise, to the MOD OFF position. In this position, not only is modulation disabled, but the maximum CARRIER LEVEL setting is increased by 6 dB; the output can now be increased by the CARRIER LEVEL control into the region calibrated on the meter's red scale extensions.

3.6 MODULATION CONTROL.

3.6.1 GENERAL.

To obtain amplitude modulation of the 1026 RF OUTPUT carrier, switch the MODULATION SELECTOR from the CW position to a suitable position for the type of modulation desired.

3.6.2 INTERNAL 1 kHZ.

In the INTERNAL 1-kHz position, a sample of the internal 1 kHz modulation is delivered to the binding posts J412 and J413 for use in synchronizing exter-

nal equipment. Percentage of modulation is adjustable from zero to at least 95% by the MODULATION LEVEL control, as indicated on the associated percent meter.

3.6.3 EXTERNAL AUDIO.

If an audio-modulating signal other than 1 kHz is desired, select the EXTERNAL AUDIO mode and connect the signal source to the modulation binding posts beneath the MODULATION SELECTOR. Use the MODULATION LEVEL control to adjust the percentage of modulation. At frequencies up to 5 kHz the maximum modulation percentage attainable is at least 95%; at higher frequencies this decreases gradually, but is still at least 50% at 20 kHz. The flat response down to dc may also be used to provide remote control of carrier level.

The meter is calibrated for sinewave audio inputs. Other waveforms (such as square waves up to 10 kHz) will be reproduced faithfully, but modulation percentage should be checked with an oscilloscope. Any change in reading of the CARRIER LEVEL meter, as the modulation level is increased, is an indication of overmodulation; less than 3-V, peak, into 3 kΩ is required to obtain 95% modulation.

3.6.4 EXTERNAL WIDE BAND.

For sine wave or square-wave modulation at frequencies above 20 kHz, or for modulation by pulses of special shapes or varying amplitudes, the EXTERNAL WIDE-BAND mode has the best high-frequency response. This mode is ac-coupled only, with a low-frequency cutoff of about 50 Hz. For full modulation, a signal of from 0.6 to 3.5 V (depending on carrier frequency) is required into 3 kΩ.

NOTE

The depth of modulation can be adjusted by the MODULATION LEVEL control, but the PERCENT modulation meter is inoperative in this mode.

An external rf envelope detector, connected to the FREQUENCY METER output connector with the FREQUENCY CALIBRATOR switch in the EXTERNAL position, should be used to monitor modulation in the WIDE BAND mode. In this mode, leveling maintains the average carrier level constant. Thus, as the FREQUENCY is varied, the modulation depth (for a fixed modulation input and MODULATION LEVEL control setting) will change. Changes in setting of the CARRIER LEVEL control will also affect the modulation depth.

3.6.5 EXTERNAL PULSE.

To generate rf pulses of a controlled amplitude, select the EXTERNAL PULSE mode and connect the output of a pulse generator with the following characteristics to the modulation binding posts beneath the MODULATION SELECTOR.

1. Positive pulse amplitude . . . 10 V minimum to 30 V maximum into 3 kΩ; any dc offset must be removed by means of a blocking capacitor.
2. Repetition rate . . . 500 Hz to 150 kHz
3. Pulse width . . . 1.0 to 33 ps (minimum 3 μs on 9.5 to 22 MHz range)
4. Duty ratio . . . maximum 50%

Increase the setting of the MODULATION LEVEL control until a reading is obtained on the CARRIER LEVEL meter. The CARRIER LEVEL control may be used to adjust the peak amplitude of the output pulses as indicated by the CARRIER LEVEL meter. The peak pulse amplitude is maintained constant as the FREQUENCY is changed or as the input-pulse characteristics are changed. Provided the pulse input is adequate to trigger the modulation circuits, the actual input amplitude has no effect on the amplitude of the emerging rf pulse.

3.7 USE AS A FREQUENCY METER.

The 1026 Standard Signal Generator can be used as a heterodyne frequency meter to measure the frequency of an external source. Place the FREQUENCY CALIBRATOR in the EXTERNAL position, plug headphones into the BEAT OUTPUT jack, and connect the source of the unknown frequency to the FREQUENCY METER jack. For best accuracy, check the 1026 calibration, using the internal crystal calibrator as described in paragraph 3.4.

If the frequency of the external source is known approximately (and is within the tuning range of the generator), its frequency can be measured directly. Tune the 1026 over the range in which the external signal lies, until a strong beat is observed, and read the frequency from the drum dial of the 1026. Otherwise, it will be necessary to identify the harmonic order of the observed beat as follows.

The signal generator should be tuned to zero beat with the external source at two or more points on the dial, noting the frequencies of a pair of successive strong beats. Bandswitching should not usually be required, since at least one pair of beats will occur on each band of the 1026 up to 220 MHz, except that band which includes the fundamental frequency of the unknown source.

Let

f_x = unknown frequency of the external source

f_h = the higher frequency of two successive strong beats

f_ℓ = the lower frequency of two successive strong beats

$f_d = f_h - f_\ell$

The harmonic order $H = f_h/f_d$ (always an integer)

$f_x = H\, f_\ell = (H - 1)\, f_h$

3.8 USE WITH EXTERNAL SYNCHRONIZER.

3.8.1 GENERAL.

When phase-locked operation is desired to stabilize the carrier frequency against an external reference, it is necessary to connect the FREQUENCY METER jack to the rf input of the external synchronizer and to connect the dc output of the synchronizer

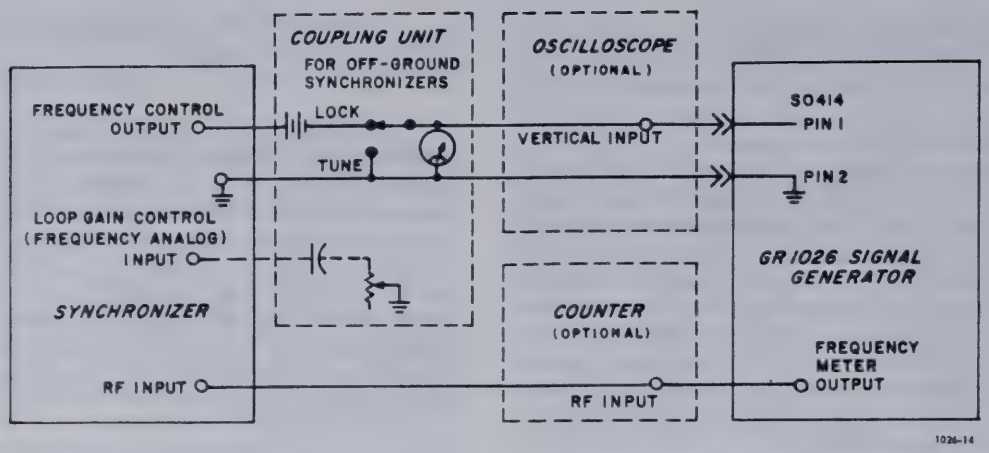

Figure 3-1. Synchronizer connections.

to pins 1 and 2 of SO414. If the synchronizer output is not centered around ground potential, it will be desirable to add a suitable Zener diode between the dc output terminal of the synchronizer and pin 1 of SO414. It may be desirable to add metering, a LOCK-TUNE switch, and a loop-gain control network, in a small accessory coupling box. The required connections are shown in Figure 3-1 and details of the coupling unit appear in Figure 3-2.

3.8.2 LOCK PROCEDURE.

To lock to a desired operating frequency:

a. Set the FREQUENCY CALIBRATOR switch on the 1026 to EXTERNAL.

b. Set the LOCK-TUNE switch on the synchronizer or accessory coupling box to TUNE.

c. Set the 1026 to the desired operating frequency (as closely as can be read from the main tuning dial).

NOTE

Restrict signal-generator modulation to 50% or less.

d. Throw the LOCK-TUNE switch to LOCK, and watch the tuning meter. If the external reference frequency and the signal-generator tuning were very close to each other before throwing this switch, the tuning meter will show a steady reading near the zero center scale mark.

When lock exists, rotation of the signal generator fine-frequency (ΔF) control (R407) will cause the meter indication to change. If it does not, the synchronizer frequency (or the signal-generator frequency) must be adjusted so that synchronizer and signal-generator frequencies are close enough to each other for lock to be established.

Since the 1026 lock range is centered around a 0-V input, it is always desirable to tune the frequency of either the signal generator or the reference of the synchronizer to center the tuning meter. This procedure ensures maximum reliability of lock, and gives assurances that the operating frequency is indicated directly by the 1026 frequency drum dial. If greater accuracy of frequency information is required, a counter may be connected in parallel with the synchronizer connection to the signal-generator FREQUENCY METER output.

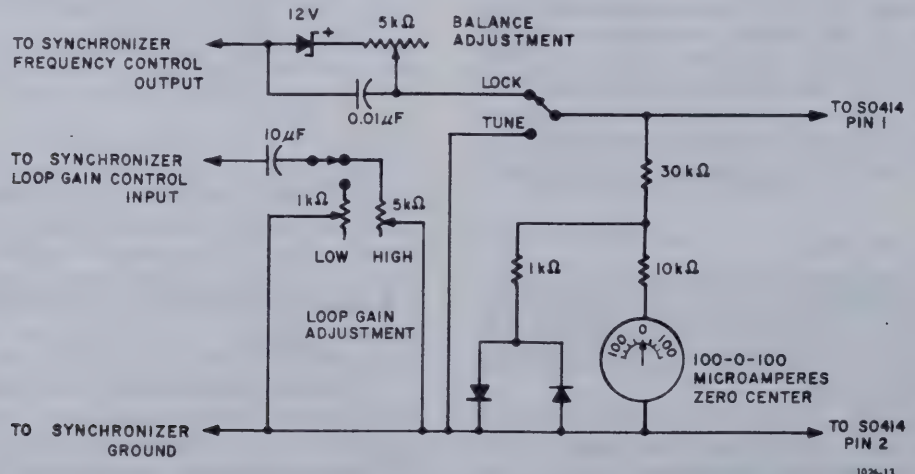

Figure 3-2. Typical coupling unit for -15 V synchronizer output.

3.8.3 SYNCHRONIZER CONTROL SIGNAL.

Normally, the control signal from the synchronizer to the signal generator is slowly varying dc. Any substantial ac component, or any steady oscillation in this voltage, indicates loop instability or possible generation of spurious signals. Initial setup using an oscilloscope is helpful in providing assurance of stable operation. Presence of large signals (greater than 0.2 V, peak-to-peak) is an indication of excess loop gain, which should be controlled by resetting the appropriate loop-gain control. Presence of small signals (typically less than 50 mV, peak-to-peak), whose frequency varies with synchronizer frequency adjustment, is an indication of spurious output due to spectral impurity of the reference frequency in the synchronizer. Such defects will be imparted to the signal generator in the form of unwanted sidebands, if ac is present on the control signal line. Usually a slight readjustment of operating frequency will permit operation with a high degree of signal purity.

SECTION 4

PRINCIPLES OF OPERATION

4.1 GENERAL.

The Type 1026 is an a-m standard signal generator, with a frequency range extending from 9.5 to 500 MHz, that is capable of operation in four modulation modes. The term "standard signal generator" means that all primary characteristics (frequency, signal level, and modulation depth) are calibrated.

The instrument consists of four major functional assemblies. They are the rf assembly, the modulator assembly, the power supply, and the front panel assembly. They incorporate the band-selection, tuning, mode-switching, level controls, indicators, input-output connectors and shielding required to provide a source of rf energy of accurately known characteristics. The over-all electrical relationship of the major assemblies (except the power supply) is shown in the simplified block diagram of Figure 4-1.

In the paragraphs that follow, each assembly is discussed in general terms with reference to a detail block diagram. Following each general discussion, the assembly's circuits are discussed in greater detail. Detailed discussions reference the appropriate schematic diagram in Section 6.

4.2 RF ASSEMBLY DESCRIPTION.

4.2.1 GENERAL (Figure 4-2).

The primary function of the rf assembly is to generate the carrier frequency, amplify it to the maximum power level required, and provide a means by which the output can be varied in accordance with a signal supplied by the modulator assembly.

The modulator output amplifier (Figure 4-3) is also located within the rf assembly to facilitate the filtering required for leakage.

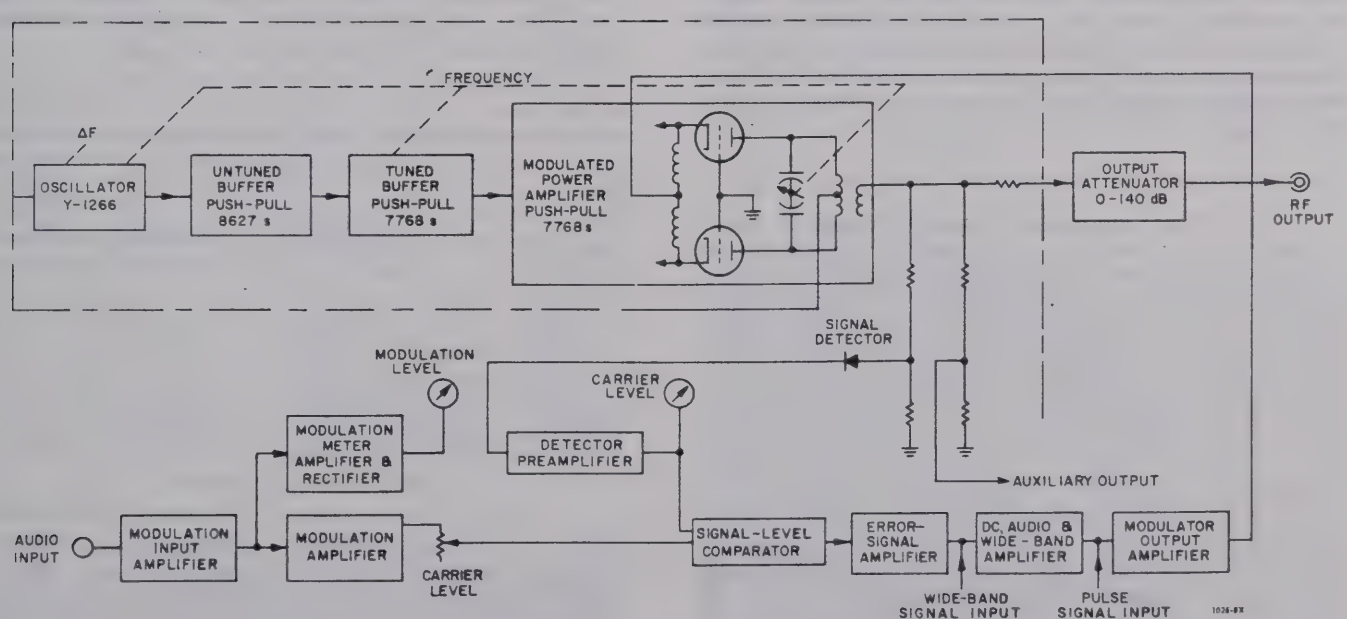

Figure 4-1. Type 1026 block diagram.

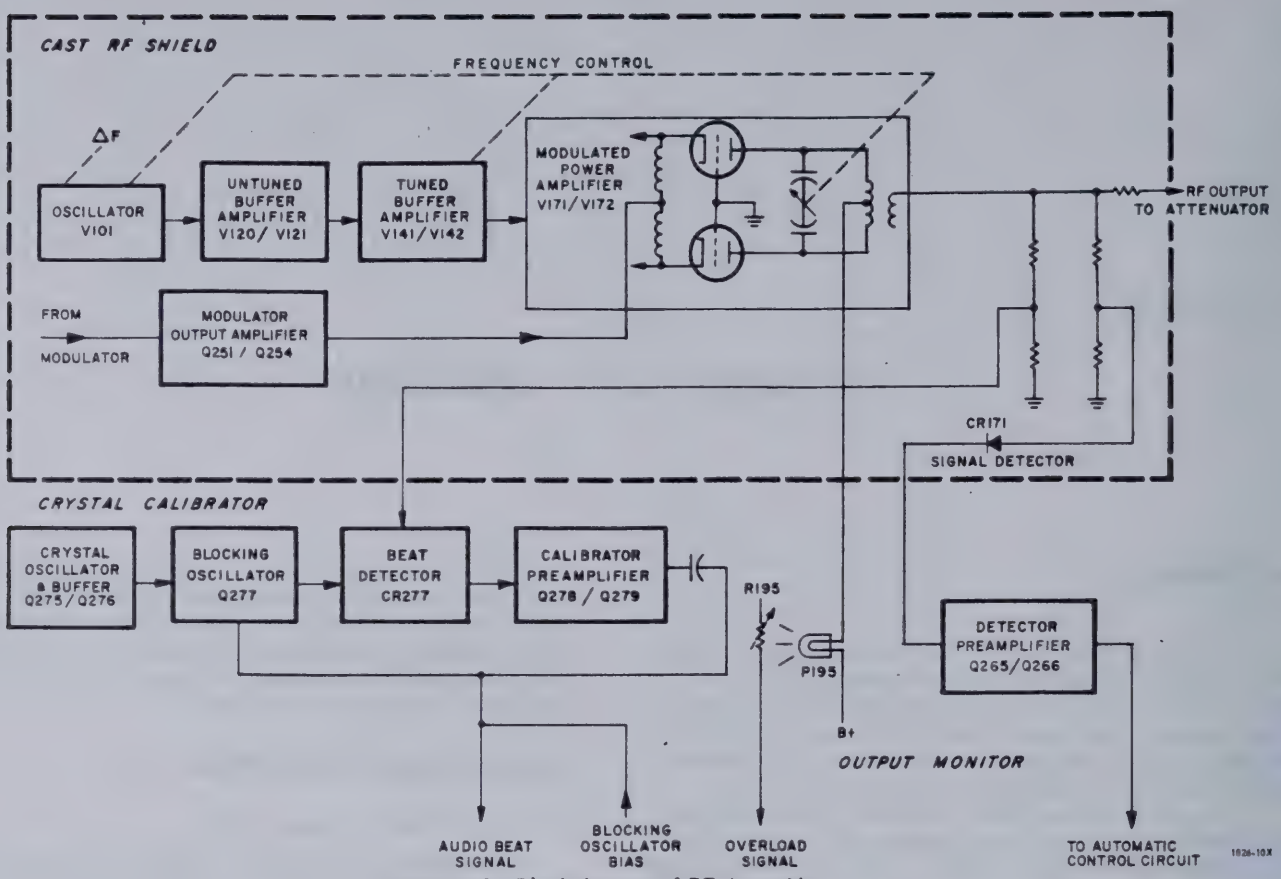

Figure 4-2. Block diagram of RF Assembly.

A diode signal detector and preamplifier monitor the rf output level and furnish a feedback signal for input to the modulator's level-control circuit.

The crystal calibrator included is useful for checking frequency calibration.

In order to deliver accurately known output over the very large output range of 160 dB, the rf unit is thoroughly shielded by use of three-compartment, cast construction and careful filtering on all leads entering the casting. Access covers, are equipped with finger contacts to maintain the integrity of the shielding.

4.2.2 BAND SELECTION AND TUNING (Figure 6-2).

The frequency range of the 1026 Standard Signal Generator is covered in six bands (selected by three tuning-coil turrets) with tuning throughout each band accomplished by three ganged sets of tuning capacitors. The tuning capacitors are operated synchronously by means of a single front-panel control; there is no auxiliary front-panel trimming adjustment.

The tuning capacitors are of the translatory motion type, and are referred to as guillotines. They are precision units, factory adjusted to a precise capacitance schedule. Their plate shapes yield a linear frequency-tuning characteristic up to 108 MHz. The moving plungers are mounted on carriages supported by ball bearings riding in precision-ground Vee-grooved rails. These carriages are in turn coupled to racks that are spring-loaded against the driving spur gears. The shaft that carries these gears is coupled to the panel control through a 50:1 worm drive. A flexible coupling joins the metal worm shaft to the control shaft, which is made of ceramic to suppress leakage.

The three coil turrets used for band selection are all on a common shaft coupled to the front-panel control by means of a helical gear drive. The six tuning ranges are identified on the schematic by band numbers I through VI for a convenient shorthand notation; Table 4-1 lists them.

TABLE 4-1
BAND NUMBERS

Band Number	*Nominal Range MHz*	*Actual Calibrated Range MHz*
I	9.5 - 22	9.5 - 22
II	22 - 48	21.2 - 49.6
III	48 - 108	47.4 - 111
IV	108 - 220	100 - 220
V	220 - 420	216 - 430
VI	400 - 500	400 - 500

Each coil has provision for inductance and capacitance trimming to insure tracking between circuits and against the precalibrated frequency dial. Capacitance trimming for bands V and VI is provided by trimmers C105, C147 and C177 mounted on the casting. A cam-operated reset mechanism at the top of the casting readjusts the settings of these trimmers

automatically for band VI. On bands I through IV, additional capacitance is provided by individual trimmers for each coil, mounted directly on the coil turrets.

B+ is fed to the active coil primaries through the primary of the next lower band coil. In the case of Band I, feed is through the Band VI coils. The pairs of feed resistors R117 and R118, R143 and R144, and R178 and R179, damp out undesired resonances in these adjacent-band coils. Additional damping for unwanted coil resonances is applied in the oscillator by R105.

4.2.3 RF OSCILLATOR.

V101 is a planar ceramic triode, type Y-1266, employed in a Colpitts-oscillator circuit. The oscillator plate current may be monitored at J101. The main tuning capacitor, C103, is paralleled by trimmers C105 (mounted on the casting) and C118 (mounted directly on C103). C105 is the main trimmer, actuated by the reset mechanism when band VI is in use. C118 compensates for capacitance changes due to oscillator tube change.

The tuning coils are L111 (Band I) through L116 (Band VI). Each consists of the tuned primary and small secondary coupling coil. The primary contacts mate with the "A" and "B" contacts on guillotine tuning capacitor C103, while the secondary contacts mate with the "C" and "D" contacts on small channels supported by the main casting. The secondary coils are connected to their contacts through suitable networks to shape the output-power-versus-frequency characteristic.

Electrical fine tuning is accomplished by varactor diode CR101. On bands V and VI a reverse bias of about 25 volts is applied to this diode in order to reduce its effect on the tuned circuit.

4.2.4 UNTUNED BUFFER AMPLIFIER.

V120 and V121, type 8627 Nuvistors, are the active elements of an untuned, transformer-coupled push-pull amplifier that provides isolation of the oscillator from variable loading effects of subsequent stages. The stage gain is approximately unity. The single-ended drive to the amplifier is delivered by two coaxial cables in parallel, which connect the C and D contacts in the oscillator to the primary of T120. The balanced secondary drives the cathodes of grounded-grid amplifier tubes V120 and V121.

These tubes operate at a substantially constant current of 40 mA, due to the large plate resistors R126 and R127; this current can be monitored at J102. The plate of V120 drives the cathode of the tuned buffer tube, V141, via step-down transformer T121. Similarly, the plate of V121 drives the cathode of V142 via T122. The broadband transformers are all of ferrite-cored, transmission-line design.

4.2.5 TUNED BUFFER AMPLIFIER.

The purpose of this stage is to supply the power gain needed to drive the output-power-amplifier stage. V141 and V142 (planar ceramic triode type 7768's) are used as a grounded-grid push-pull amplifier.

The main tuning capacitor, C146, tunes coils L151 (band I) through L156 (band VI). The push-pull tuned primaries of these coils connect directly to contacts on C146, while the single-ended secondaries are connected through appropriate networks to output contacts C and D, mounted on a channel supported by the main casting.

The tubes operate at a constant current of 47 ±3 mA, due to the large cathode resistors (R122 and R123) which are returned to the -12.4 V supply, while the grids are grounded directly. The total plate current can be monitored at J103.

4.2.6 POWER AMPLIFIER.

The primary purpose of this stage is to permit amplitude modulation of the carrier. The single-ended output of the tuned buffer is brought to the input coupling network of the power amplifier by two coaxial cables in parallel. These drive transformers, T171 and T172, which are connected in parallel. T171 is a 1:1 phase-reversing transformer that drives the cathode of V171, while T172 is a 1:1 noninverting phase-compensating transformer that drives the cathode of V172. V171 and V172 are also type 7768 triodes, operated grounded grid.

The transformers are coupled to the cathodes through RLC networks to permit insertion of the modulation voltage in the cathode-to-ground return at anchor terminal AT170.

The dc bias at this point can be monitored by connection of a meter to TP101. This bias varies from slightly over +1 V when the amplifier is turned on hard delivering maximum output, to as high as +20 V when the level control is turned down near minimum. The bias and plate current vary with frequency for each range, even at a fixed output setting.

The main tuning capacitor for this stage is C172, which tunes the primaries of coils L181 (Band I) through L186 (Band VI). The capacitor contacts to the coil primaries are A and B. The coil secondaries are coupled to output contacts C and D directly, except on bands IV and V, in which isolating transformers T184 and T185 are employed to break up an unbalanced harmonic ground current.

4.2.7 OUTPUT LEVEL MONITOR.

The power amplifier output is delivered via contacts C and D directly to a low-pass filter at the monitor input, consisting of C189, C190, plus FL187 and FL188. Following this filter is a compensated voltage divider, consisting of C185, C186, R187 and R188, which delivers approximately 2/3rds the output voltage to detector diode CR171, the output of which is fed to J108.

Another voltage divider, R175 and R176, delivers approximately 1/11th the output voltage to J109 for subsequent use in the frequency calibrator. The voltage at the junction of R177 and R187 is held constant by the automatic level-control circuits, thus making the effective impedance at that point zero. The main output of the monitor is then delivered via 50-ohm resistor R177 to the output attenuator via J105. R177

determines the effective output impedance of the signal generator when the output attenuator assembly (A400) is set to its maximum (+20 dBm) position.

4.2.8 DETECTOR PREAMPLIFIER.

Network R265, R266 and R267 supplies forward-bias current to monitor diode CR171, in order to linearize the diode characteristic. The detected output from the diode is amplified by Q265 and Q266, connected in a feedback configuration. This provides a low output impedance to drive output filter FL271 via resistor R271.

4.2.9 OVERLOAD PROTECTION.

Plate current to the rf output amplifier tubes, V171 and V172, is fed through a 60-mA pilot lamp, P195, which in turn illuminates photoresistor R195. The spacing of these elements is adjusted so that plate current exceeding 55 mA reduces the resistance of R195 sufficiently to insert an overriding control signal into the modulator control loop. Thus, plate current is limited to a safe value under conditions of excessive loading, such as may occur at certain carrier frequencies (in the 10 V CW mode) with high-VSWR rf loads. The lamp also acts as a fuse in case of any catastrophic failure in the modulator or in the power amplifier.

4.2.10 CRYSTAL CALIBRATOR.

The crystal calibrator comprises a crystal-controlled pulse generator that drives a diode mixer to which a small sample of the signal-generator output is also applied. When the signal frequency is close to being an integral multiple of the pulse repetition rate, the resulting audio beat note is amplified and delivered to a front-panel headphone jack, J415. The principal circuits involved are contained in the small shield can at the top of the rf assembly.

The crystal oscillator, Q275, is of the series-resonant Pierce type. Internal adjustment capacitor C275 sets the operating frequency to exactly 5 MHz. Isolating amplifier Q276 drives blocking oscillator Q277. This oscillator operates either at 5 MHz or as a 5:1 divider at 1 MHz. The selection is made by the front-panel FREQUENCY CALIBRATOR function selector S400, that controls the bias fed via filter C292 to Q277.

The heterodyne output of diode mixer CR277 drives preamplifier Q278 and Q279, a feedback pair with very low output impedance. The preamplifier output is delivered to the subsequent headphone amplifier through C292, the same filter capacitor used to supply bias voltage to the blocking oscillator The audio voltage on this lead is so low that it does not adversely affect operation of the blocking oscillator.

4.2.11 MODULATOR OUTPUT AMP.

NOTE

Although this circuit is functionally part of the over-all modulator circuitry, it is physically located in the rf assembly to simplify the lead filtering required for shielding.

The amplifier increases the level of control signals (delivered by the modulator assembly) sufficiently to modulate the power amplifier output essentially 100%. Positive-going signals at the input of FL251 cause a positive-going signal at the cathodes of V171 and V172, resulting in a reduction of rf output. In the pulse mode, the normal level-control signal applied through FL251 is overridden between pulses, but is restored for the duration of the pulse.

The carrier level control signal, including modulation information in the 1 kHz, EXT AUDIO, and WIDE BAND modes, is fed to input amplifier Q251, an emitter follower, through low-pass filter FL251. In all except the PULSE mode of operation, Q252 is biased off and has no effect on circuit operation.

The output amplifier, Q253 and Q254, is a non-inverting feedback pair capable of delivering voltages from approximately +0.5 V to +25 V at currents up to the 55 mA required under certain conditions by the rf output amplifier tubes, V171 and V172. When positive bias is applied to the cathodes of these tubes, rf output is reduced.

In the pulse mode, Q252 is normally conducting, and therefore the drop in R255 adds a positive bias to the dc level-control signal coming from Q251, turning off the output amplifier Q253/Q254. When a positive pulse is applied through low-pass filter FL252 to the input of Q252, the current through R255 is cut off, and the output amplifier assumes the level commanded by the level-control signal from Q251.

4.3 MODULATOR ASSEMBLY DESCRIPTION.

4.3.1 GENERAL (Figures 4-3 and 6-3).

The modulator assembly provides a low-frequency signal of proper amplitude to vary the rf carrier level. In the 1-kHz modulation mode, the low-frequency modulating signal originates in the modulator assembly itself. In all external modulation modes, the low-frequency modulating signals originate outside the instrument, with the modulator assembly providing only amplification and level-control functions.

The modulator assembly consists of four functional groupings of circuit elements. These are the 1-kHz oscillator, the error amplifier board, the modulator board, and the pulse stretcher board. Considerable switching is also furnished by S200 to modify the function of these circuits, as required for the various modes of operation. Carrier-level and modulation-level meter-adjustment circuits are also modulator assembly functions. For purposes of clarity, the detailed discussions of these circuits are presented in the following paragraphs in terms of the various operating modes.

4.3.2 CW MODE.

In this mode, the modulator holds the rf carrier at the level preselected by the CARRIER LEVEL control (R405) without applying any modulation. This is true despite changes in frequency, load, or ambient temperature.

One of the primary elements in this automatic level control is the broad-band, linear rf detector in the rf assembly (Figure 6-3). This detector, CR171, rectifies a portion of the rf output voltage and delivers

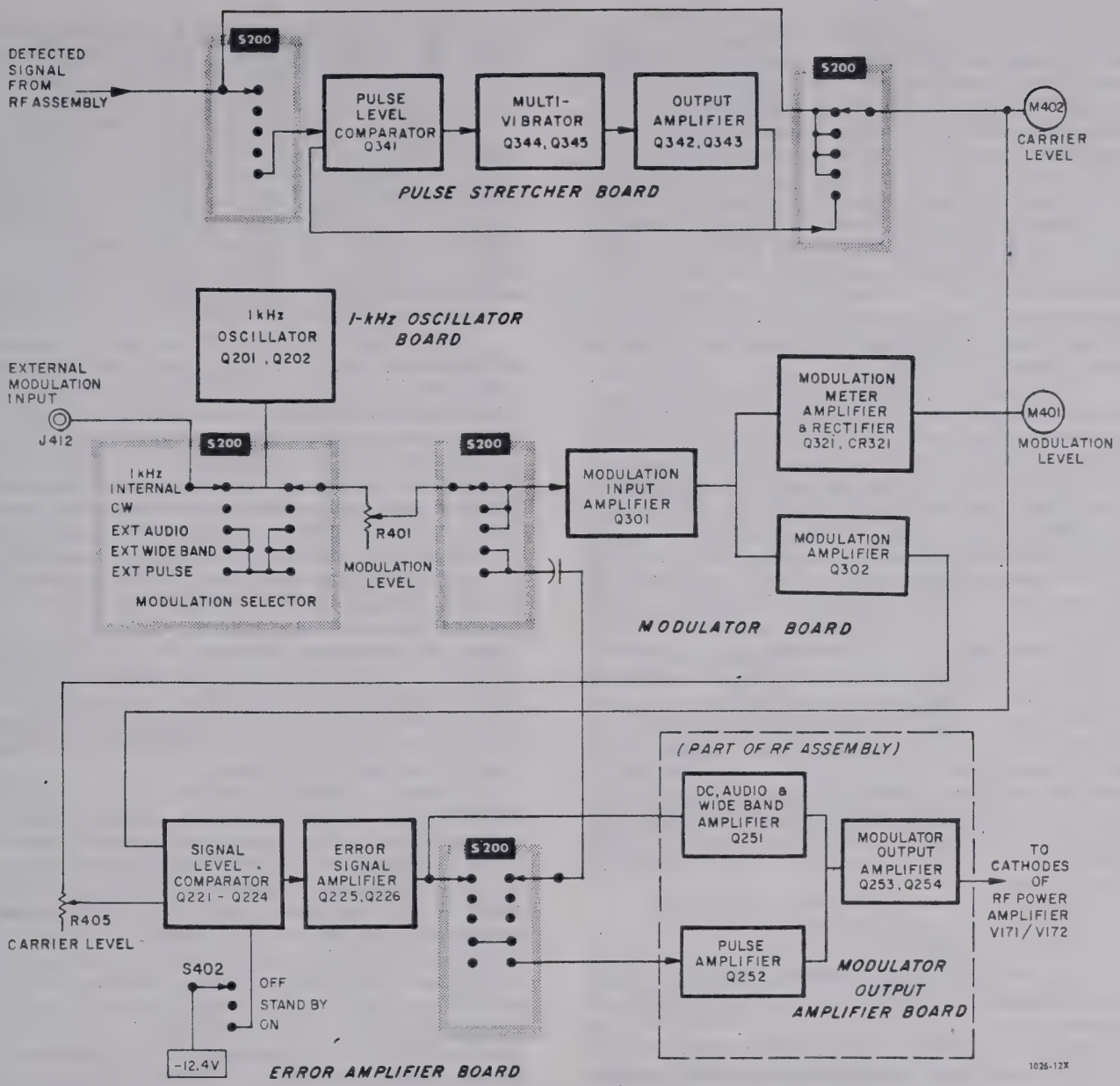

Figure 4-3. Block diagram of Modulator Assembly.

a dc voltage proportional to the applied rf. This dc voltage is amplified by the detector preamplifier, Q265/Q266, a low-distortion, low-impedance driver for feedthrough filter FL271, which removes any rf residue present with the detected dc.

The detected signal is then applied to the CARRIER LEVEL meter circuit and to the base of Q224, in the modulator assembly (Figure 6-3). Q224 is one side of a differential amplifier consisting of Q221 through Q224. The action of this amplifier is described later after its other input, the CARRIER-LEVEL control signal applied to the base of Q221, is traced.

The carrier level control signal required at the base of Q221 is established as follows. Starting at ground dc level, a positive dc offset voltage (corresponding to that which would arrive from the detector preamplifier for a 5-V carrier level) is added to the modulation input circuit. The bias path starts at R401, the MODULATION LEVEL control, which is returned to ground; thus, ground serves as a dc level reference. In this mode, R401 performs no function, since it is disconnected from the EXTERNAL modulation terminal, J412. The bias path leads to Q301, an emitter follower whose primary function is impedance matching. Q301 drives the low end of a resistive voltage divider consisting of R305, R306, R310 and R311. The current through this divider is adjusted by R551, the "Modulator Offset Voltage Adjust" control located in the power supply. This establishes the dc offset voltage at the base of Q302, which corresponds to a 5-V carrier level when the CARRIER LEVEL control is fully clockwise. Q302 is an emitter follower which drives the high side of R405, the CARRIER LEVEL control.

The arm of CARRIER LEVEL control R405 leads to the base of Q221, thus providing the reference input to the error amplifier. This reference level is identical in magnitude (except for the residual error signal of about 50-mV) to the output of the detector preamplifier; it varies over the range of approximately +3.2 V to -0.5 V, as the carrier level is reduced from 5 V to 1 V. The nominal differential gain between the bases of Q221 and Q224 and the collector of Q223 is 16, the common-mode gain being 0.35. The exact value of the differential gain is adjusted by R222 ("Loop Gain Adjust" control) to make the over-all loop gain equal to a maximum of 54 dB, giving about a minimum of 40-dB loop gain at the least favorable setting of the FREQUENCY dial.

The emitters of Q221 and Q224 and those of Q222 and Q223 are returned to the -12.4 volt supply, the latter pair returning through auxilliary contacts on the main POWER switch (S402). When S402 is in the STANDBY position, the emitter lead is opened, raising the collector of Q223 to the 30-V supply level and thereby cutting off all subsequent stages.

Error-amplifier output stages Q225 and Q226 furnish the proper level to drive the 800-ohm impedance of FL251. The termination of this filter in the rf section is also the collector load resistor for Q226. FL251 is identical to FL271, keeping any rf present at the power-amplifier cathode return from leaking out through the modulator output amplifier.

The output of Q226 is fed to the modulator output amplifier, Q251 through Q254. Q253 and Q254 are a feedback pair providing the desired low impedance as well as a nominal voltage gain to the cathode circuit of the rf power amplifiers. Q252 is required only for pulse and wide-band modes of modulation; in the CW MODE, Q252 is cut off and Q251 acts as a simple emitter follower.

4.3.3 10-VOLT CW MODE.

The 10 VOLT CW OUTPUT mode is a special case of operation in the basic cw mode; it is described separately in the interest of clarity.

When the MODULATION SELECTOR switch (S200) is in any one of the three positions INTERNAL 1 kHz, CW, or EXTERNAL AUDIO, the MODULATION LEVEL control in its extreme CCW position not only disconnects any internal 1 kHz or external modulation signal from the input to Q301, but substitutes a dc signal which increases the maximum output of the signal generator by approximately 6 dB. The carrier level meter will indicate this change directly.

The dc signal comes from a voltage divider consisting of R402, R403, and R404. The tap of R403 (10 V CW ADJ control) is connected by S401 to the base of Q301 in place of MODULATION LEVEL control R401.

4.3.4 EXTERNAL AUDIO MODE.

When the MODULATION SELECTOR switch (S200) is set in the EXTERNAL AUDIO mode, the only change in circuit connection from the CW mode is that the high side of the MODULATION LEVEL control (R401) is now connected to the modulation jack, J412. Thus, any modulation signal applied to J412 is added to the dc carrier-level-control bias; the resulting composite signal constitutes the reference input to the error amplifier. Thus, the envelope of the rf output is a replica of the modulation input signal.

In this mode, the CARRIER LEVEL meter circuit responds to the average value of the modulated voltage presented to it. For symmetrical modulation such as sinusoidal, or any modulation coupled into the instrument by way of a capacitor, the CARRIER LEVEL reading on M402 is unaffected by the presence of modulation unless it exceeds 100%. However, any modulation having a dc component will change the carrier level, hence the CARRIER LEVEL reading.

The signal between the external modulation jacks J412 and J413, and the input to the differential error amplifier (base of Q221) follows the same path as previously described for cw operation; in addition, the modulation input signal is amplified by Q321 and rectified by CR321 for display on the MODULATION LEVEL meter (M401). The rectifier circuit is a quasi-peak detector which is calibrated using a sine-wave; signals of other wave shapes do not necessarily give an accurate reading of modulation percentage.

An important component in this mode is R309, the % MOD ADJ control. This control is necessary because of the dc offset present, even at zero carrier level. Returning the low end of the CARRIER LEVEL control to an adjustable dc divider (the arm of R309), ensures that the ratio of audio to dc voltage at the arm of the CARRIER LEVEL control (R405) is such that the modulation indes will remain constant regardless of the control's setting.

The error amplifier in this mode establishes a controlled gain-versus-frequency characteristic. To accomplish this, there are four "roll-off" networks that act like simple RC low-pass filters except that, as the frequency is increased beyond a transition region, the attenuation becomes constant instead of approaching infinity, and the phase shift again approaches 0° instead of 90°. The first of these consists of R230 and C221 that act with collector loads R221 and R231 as the source, to establish a first break frequency of 650 Hz. R229, R235, R237 and C224 make up the second roll-off network, which breaks at 1150 Hz; the third is composed of R238, R240 and C226, which breaks at 20 kHz. The last roll-off network is made up of the collector load of Q226 (R251 located in the rf section) along with R246 and C243, which breaks at 55 kHz.

In the region of 100- to 300-kHz, a slight lead is introduced by R234, R236, and C222, to prevent too rapid gain roll-off.

The modulator output amplifier has the same functions as previously described for the cw mode.

4.3.5 1-kHz INTERNAL MODULATION.

All the circuitry described for the preceding modes is used in this mode, as well as the 1-kHz oscillator itself, which is switched to the high side of the MODULATION LEVEL control by S200-2.

The 1-kHz oscillator is a conventional Wien-bridge circuit. The 1 kHz ADJUST (R203) varies the frequency ±1 percent. The oscillator amplitude is controlled by thermistor R213, so that operation is restricted to the linear range of Q201 and Q202. As

the ambient temperature varies, R213 causes significant variations in output amplitude, so a second thermistor, R214, compensates for these variations.

The 1-kHz oscillator is left on at all times to avoid switching transients when the MODULATION SELECTOR is set to the 1 kHz INTERNAL MODULATION mode. Otherwise there would be an initial surge in output level caused by the thermistor's thermal time constant. When the MODULATION SELECTOR switch is in the INTERNAL 1-kHz position a portion of the 1-kHz oscillator output is coupled to J412 (through R312) to permit synchronization of an external oscilloscope or synchronous detector.

4.3.6 WIDE-BAND MODULATION.

In the EXTERNAL WIDE BAND mode, the dc operation of the modulator is the same as in the EXTERNAL AUDIO mode except for changes to the reference input circuits and to the roll-off networks. The base of Q301 is returned to ground through R302 and R303 via S200, leaving the MODULATION LEVEL control (R401) free to be used as described below. In addition, the low side of the CARRIER LEVEL control (R405) is connected to the -12-V supply via R314. Thus, in the extreme CCW position of the control, the bias applied to the base of Q221 is sufficiently negative to drop the carrier level to zero.

Additional high-frequency roll-off filtering (C225 and C341) is switched in by S200-1 and S200-4, so that the first frequency break now occurs in the vicinity of 0.02 Hz, with the crossover about 10 Hz. For modulation frequencies above about 10 Hz, there is no significant feedback.

The modulation input is brought through MODULATION LEVEL control R401 to the collector of Q226 via C303 and R247. Here, the modulation signal is added to the dc-carrier-level control signal. The composite signal is amplified in output amplifier Q251, Q253 and Q254, and then applied to the cathode of the rf power amplifier tubes. Since the output amplifier is non-inverting, the modulation applied is opposite in sense to that of all other modes, so a positive input swing causes a drop in rf output. The modulation bandwidth for carrier frequencies above 108 MHz is approximately 50 Hz to 1.5 MHz, as determined by the bandwidth of amplifier Q251 - Q254. But, as there is no envelope feedback, the modulation is not as linear as in the EXTERNAL AUDIO mode. The MODULATION LEVEL meter does not function in this mode.

4.3.7 PULSE MODULATION.

In this mode it is possible to modulate to a peak rf pulse level that is controlled by a feedback circuit. The rms value of the rf voltage occurring during the pulse is read directly on the CARRIER LEVEL meter. The percent modulation meter is inoperative, but the modulation percentage is kept as high as possible; the on-off ratio is at least 30 dB. The pulses must recur at a rate of at least 500 per second, be of at least 1-μs duration, and be of at least 10-V, peak, amplitude, positive going; certain other restrictions are listed in the specifications.

Between pulses, the cathodes of V171 and V172 (in the rf section), are biased to +25 V, thus cutting off plate current and power output. Incoming pulses drive the cathodes down to an operating bias level which is automatically controlled so that the rf amplitude at the peak of the pulse is that selected by the setting of the CARRIER LEVEL control. This operating bias is an essentially steady-state voltage established by comparing the peak pulse amplitude (detected by CR171, amplified by the detector preamplifier, and converted to dc in the pulse-stretcher circuit) to the dc from the CARRIER LEVEL control, and amplifying the difference.

The dc-bias signal is applied via FL251, while the pulses that switch the modulator output amplifier from the +25-V output (V171/V172 cutoff) to the operating-bias condition are applied through FL252. The dc from FL251 passes through emitter follower Q251, to drive the output feedback pair Q253 and Q254 via a resistive combining network, R255 and R256. Between pulses, Q252 conducts heavily, by virtue of base current being drawn through R262, FL252, and R243 to ground. Its collector is in saturation, holding the base of Q253 close enough to +30 V to cut off Q254; the modulator output signal at the collector of Q254 is at about +25 V, effectively cutting off V171 and V172.

Pulses applied to J412 are routed through MODULATION LEVEL control R401, S200-2, C303, and S200-3 to FL252. A positive input pulse of sufficient magnitude applied to FL252 drives the base of Q252 positive, until CR252 clamps. This cuts off Q252, allowing the base of Q253 to assume the bias level established by the dc input to FL251, for the duration of the pulse. The collector of Q254 is thus set at the appropriate operating bias voltage and the rf pulse is generated.

The dc-bias signal applied to FL251 is generated in the same manner as for the EXTERNAL WIDE BAND mode, except for the interposition of the pulse stretcher in the detected signal path, between the output of the detector preamplifier and the input of the level comparator.

The pulse stretcher circuit generates a dc bias that is equal to the peak amplitude of an incoming detected pulse. The bias is built up across C343 by charging current flowing through R351 and R352, under the control of Q345. If the incoming pulse is larger than the bias across C343, more charging current flows until the two voltages are essentially equal. If the pulse is smaller, discharge current flowing through R353 reduces the bias until equality is achieved.

The comparison of pulse and dc bias occurs in the base to emitter circuit of Q341. The pulse is applied directly to the base, while the dc bias from C343 is coupled to the emitter by a unity-gain feedback amplifier, Q342 and Q343.

CR341 is a coupling diode that allows a transition to take place without being loaded by the input triggering circuit. Triggered into the metastable state, Q345 is turned off. Its collector voltage rises, raising with it the voltage at the junction of R352 and R353, thereby imparting a small increase in the voltage across C343. Diodes CR342 and CR343 are clamping diodes that limit the negative excursion of C343.

The output of the pulse stretcher is taken at the junction of R344 and R345; R345 provides a small dc offset to approximate the base-to-emitter voltage of Q341. This output is delivered via S200-4 to the "Detected Signal" input of the level comparator, that is, to the base of Q224, where it is compared with the dc from the arm of CARRIER LEVEL control, R405. The comparison is accomplished in the differential portion of the error amplifier. The gain of this amplifier is drastically reduced in this mode as contacts 108F and 109F of S200-1 open the bridging path between emitters of Q221 and Q224.

The circuit is similar to EXTERNAL WIDE BAND in that a relatively large amount of filtering is used, limiting the speed of response to level or load changes. The output of the error amplifier is the bias that establishes the rf level during the on-time of the pulse. It is the same bias that would be present for an identical CW level.

4.4 POWER SUPPLY ASSEMBLY.

4.4.1 GENERAL (Figure 4-4).

For purposes of discussion, the Type 1026 Standard-Signal Generator power-supply assembly is divided into three sections, preregulator, rectifier-filter, and postregulator. The preregulator stabilizes the supply against line-voltage variations. It consists of a reference source, a sampling rectifier-filter network, a control amplifier, and magnetic regulators, all associated with the power-transformer's primary side. The postregulator provides stability against load variations and ripple. It is comprised of suitable reference sources, control amplifiers, and series-losser circuits for both the +220 V and -12.4 V supplies, with a simpler reference and series losser arrangement for the +30 V supply.

4.4.2 PREREGULATOR.

The primary function served by this regulator is to regulate against changes in line voltage in such a manner that:

1. The main control elements are reactive rather than dissipative, thereby limiting the generation of heat.

2. The series-type postregulator operates with voltage drop sufficient to compensate load fluctuations and ripple, without need for an additional drop to allow for line-voltage fluctuations. Thus, power dissipation is minimized.

3. The variation in total heat dissipated, as line voltage varies, is also reduced. Therefore, once the Type 1026 comes up to operating temperature, possible frequency or level drifts due to line-voltage shifts are likewise reduced.

4. The preregulator holds the ac heater voltage on the rf buffer and power-amplifier tubes within approximately ±2 percent, so tube life is maintained with no need for further regulation of this voltage.

The basis of the preregulator is a magnetic amplifier consisting of saturable reactors L502A/B and associated control circuits. These reactors are used to switch the line voltage, on a time-sharing basis, between the full transformer winding and a lower voltage tap. When the switches formed by L502 are open, line current flows through L501 to the end of the transformer primary. Since L501 saturates, the voltage drop through it is relatively low. At high line voltages, the line is connected across the full primary winding for most of each cycle, while at low line voltages, it is connected to the tap for most of each cycle.

When the switches formed by L502 are closed, line current flows through them (with relatively low drop) to the tap on the transformer winding and L501 floats across the portion of the transformer between

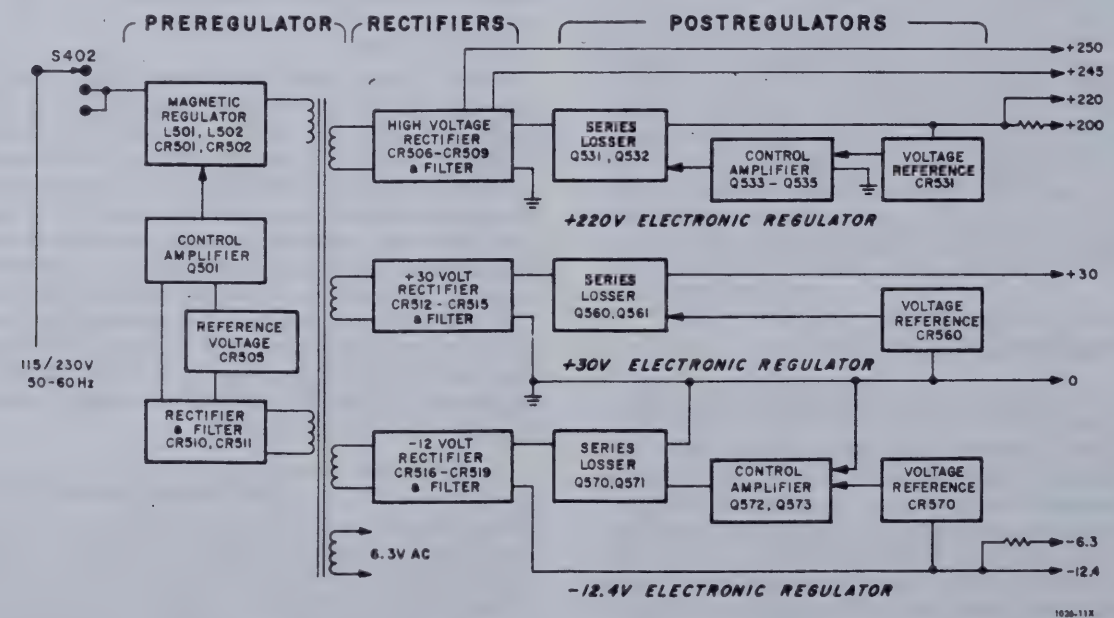

Figure 4-4. Block diagram of 1026 Power Supply.

the tap and the end of the winding; it is no longer carrying line current, and hence is no longer saturating. Since line current is flowing to one tap or the other during the entire cycle, the wave shape applied to the load has only moderate transients and relatively low harmonic content. Thus, the form factor (ratio of peak to rms) is relatively constant, and the dc output of the quasi-peak capacitor-input rectifier-filter circuits, and the rms output from ac heater windings, are both regulated.

The time in the cycle at which L502 saturates and starts conducting depends on its previous magnetic history, as determined by the flow of reset current through Q501, which acts as a variable resistor. The amount of current it passes is determined by comparing a portion of a dc voltage, derived by rectifying the output from a special secondary winding, to a Zener reference diode, CR505. In operation, a sudden increase in line voltage causes a slight rise in the voltage between transformer terminals 16 through 18 (as well as all other terminals), so that a rise in the voltage out of CR510 and CR511 (the full-wave rectifier) is applied to a bridge consisting of CR505, R502, R504, R505 and R506. This increase in voltage across the bridge increases the drop from the plus side of CR505 to the tap of R505; the increased negative voltage at that tap is applied to the emitter of Q501, turning it on harder.

The increased reset current flowing in the collector circuit of Q501 causes the reactors to saturate later in the half cycles. Thus the line remains connected to the end of the transformer via L501 until later in the cycle. Consequently the transformer output voltage is reduced, thereby counteracting the effect of increased line voltage.

The primary of power transformer T501 is tapped, as mentioned above, for the preregulator. It is split to allow 230-V operation and in all other respects is conventional. The rectifier and filters are also standard.

4.4.3 POSTREGULATOR.

The three postregulators are relatively conventional series types. In all three, the series element is a "White" emitter-follower pair, having unity gain and low output impedance.

The 220-volt regulator employs a differential amplifier, Q533 and Q534/Q535, to compare the drop across the 20-V Zener diode, CR531, with the drop across a portion of the resistive divider, R544, R545, R546, R547 and R548. The use of thermistor R547 provides compensation against temperature-voltage drift. Capacitors C533, C535, and C536 provide the frequency roll-off control needed for stability of the feedback loop. The value of R552 is selected for optimum compensation of the output voltage against variations in input voltage.

The 30-V regulator is straightforward. The White emitter follower holds the output (collector of Q560) equal (except for base-to-emitter offset of Q561) to the voltage at the base of Q561; this voltage is determined by the 30-volt Zener diode, CR560. C561 is necessary to filter out some of the noise from CR560.

The -12.4-V regulator has the greatest requirements for regulation and ripple reduction. It furnishes the largest gain around the control loop. The -12.4-V output is compared with the voltage across 10-V Zener diode CR570 in the base-to-emitter circuit of Q573. Additional gain is supplied by Q572. C571 and C572 are roll-off filters required for stability of the feedback loop.

4.5 FRONT-PANEL ASSEMBLY.

4.5.1 GENERAL.

The front-panel assembly contains all the operating controls and meters used in the 1026 Signal Generator. In addition the audio amplifiers used to amplify the crystal-calibrator beat-output signal are located in this assembly.

4.5.2 AUDIO AMPLIFIER.

The audio-amplifier consists of three capacitively coupled, Class-A stages with a series audio gain control, R417. The output is taken at J412, the BEAT OUTPUT jack.

4.5.3 OUTPUT ATTENUATOR.

The output attenuator, A400, is a resistive step attenuator which controls the rf output from +20 dBm to -120 dBm in 10 dB steps. Since most of the resistors employed are small film types, the user should avoid connecting any source of power capable of delivering more than 1/4 watt to the rf output connector, J407.

The attenuator includes the input switching required to provide proper impedance characteristics and straight-through operation with zero insertion loss. After an impedance-matching 10-dB input section, the attenuator is a continuous 100-ohm ladder. This provides a 50-ohm output impedance since the output always sees the source and load segments of the ladder connected in parallel.

The extremely low VSWR of the output impedance (less than 1.05 over the whole frequency range) is due to close control of resistor values and of physical dimensions, as well as of the size and shape of the shield pockets in which the resistors are located.

At the output tap, special rotating shield members are used to prevent pickup of stray leakage from the input, which could reduce the accuracy of the attenuator at the extremely high maximum insertion loss of 140 dB. Resistors are aged and checked for stability to ensure long-term accuracy.

Figure 6-1. BLOCK DIAGRAM OF 1026-A STANDARD SIGNAL GENERATOR

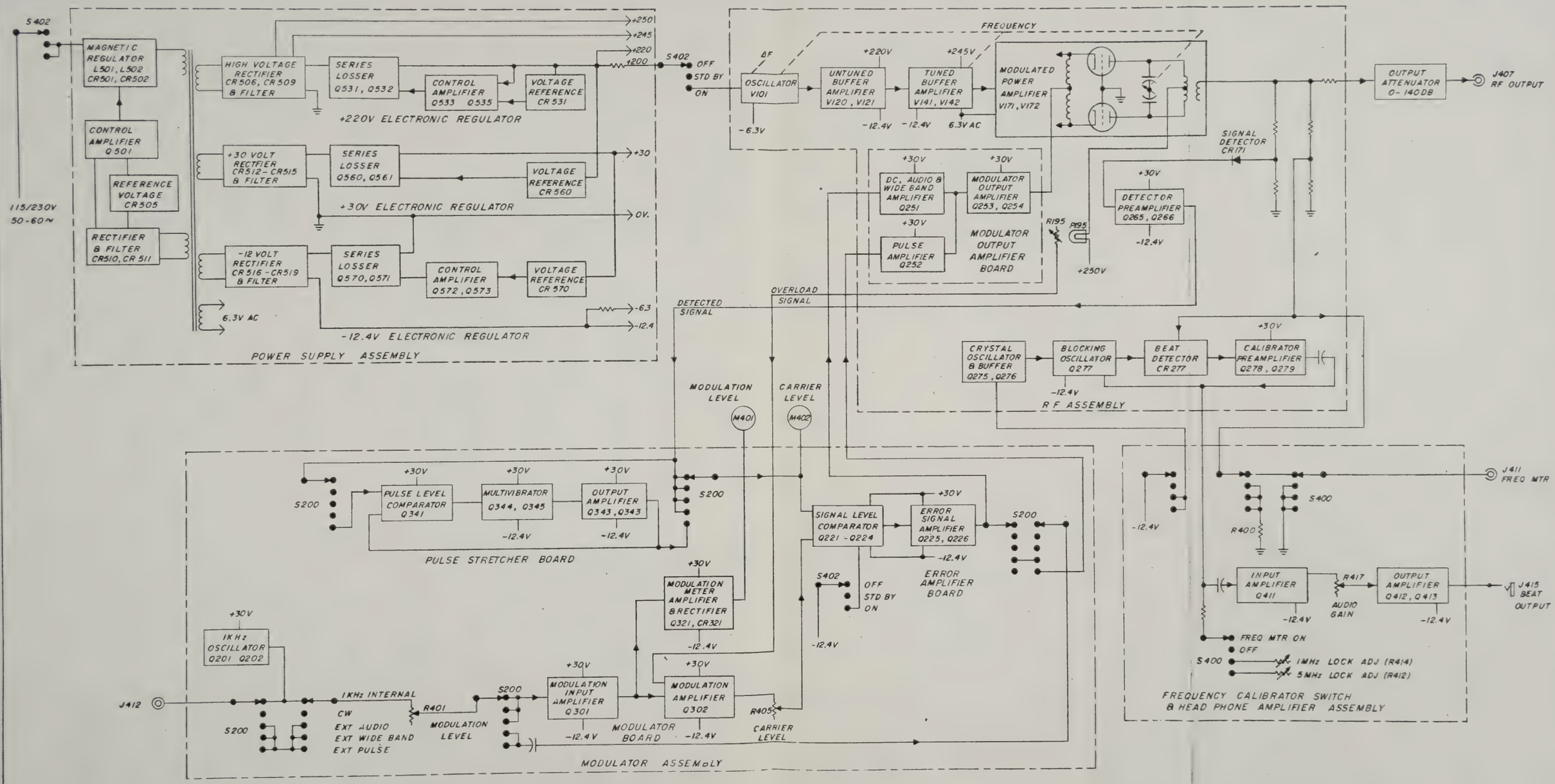

Figure 6-2. SCHEMATIC DIAGRAM OF 1026-A RADIO FREQUENCY ASM.

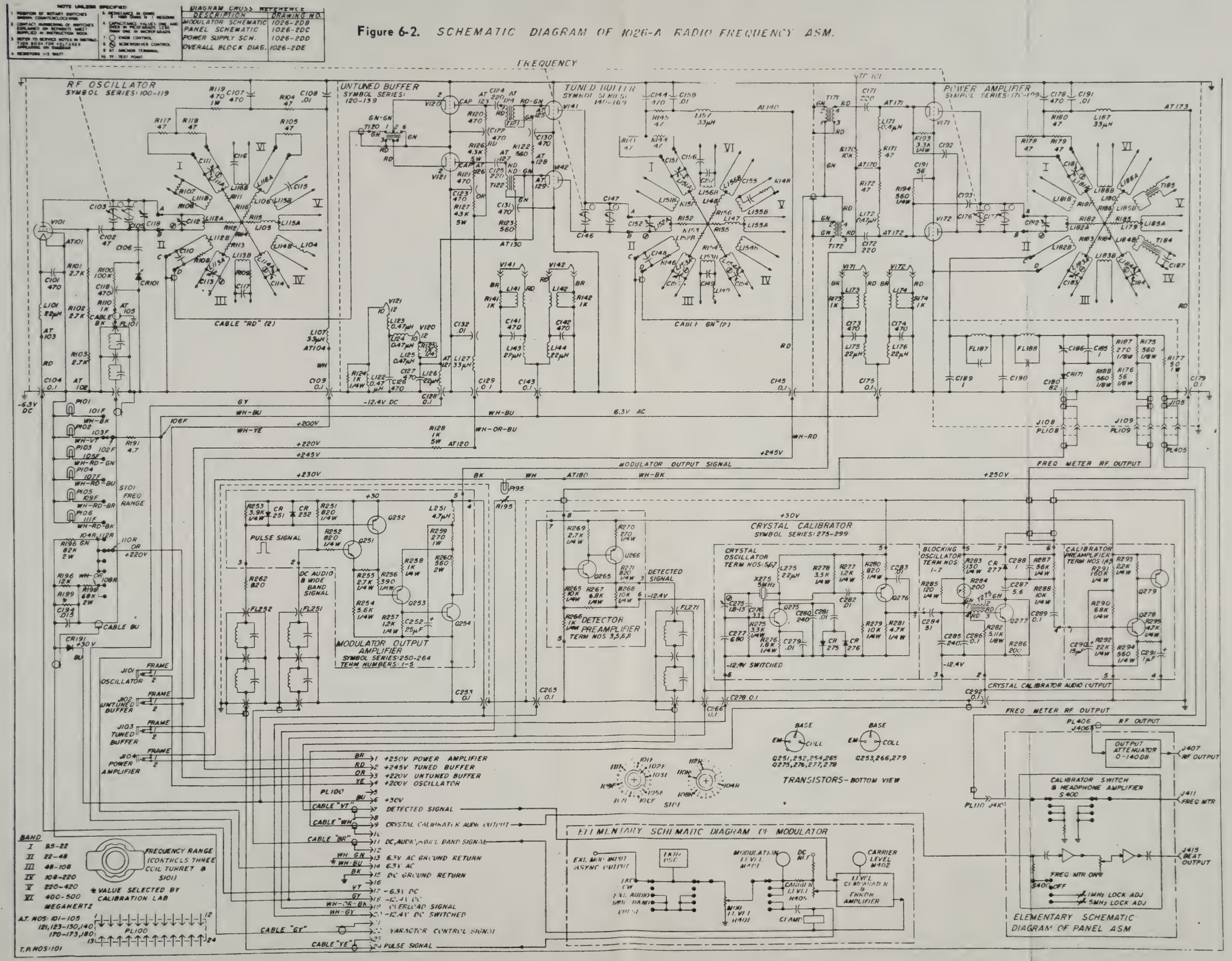

Figure 6-3.

NOTE UNLESS SPECIFIED

1. POSITION OF ROTARY SWITCHES SHOWN COUNTERCLOCKWISE
2. CONTACT NUMBERING OF SWITCHES EXPLAINED ON SEPARATE SHEET SUPPLIED IN INSTRUCTION BOOK
3. REFER TO SERVICE NOTES IN INSTRUCTION BOOK FOR VOLTAGES APPEARING ON DIAGRAM
4. RESISTORS 1/2 WATT.
5. RESISTANCE IN OHMS K 1000 OHMS M 1 MEGOHM
6. CAPACITANCE VALUES ONE AND OVER IN PICOFARADS LESS THAN ONE IN MICROFARADS
7. KNOB CONTROL
8. SCREWDRIVER CONTROL
9. AT ANCHOR TERMINAL
10. TP - TEST POINT

S200-1(SECTION 1) S200-2(SECTION 2) S200-3(SECTION 3) S200-4 (SECTION 4)

SCHEMATIC DIAGRAM OF 1026-A MODULATOR ASM.

DIAGRAM CROSS-REFERENCE LIST

NAME OF DIAGRAM	DWG. NO.
RADIO FREQUENCY SCHEM.	1026-2DA
PANEL SCHEMATIC	1026-2DC
POWER SUPPLY SCHEMATIC	1026-2DD
OVERALL BLOCK DIAGRAM	1026-2DE

TRANSISTORS — BOTTOM VIEW

Q201, 221, 222 Q223, 224

Q202, 225, 343

Q226, 301, 302 Q321, 341, 342 Q344, 343

1026-2735 AUDIO OSCILLATOR BOARD SYMBOL SERIES: 201-219

1026-2716 ERROR AMPLIFIER BOARD SYMBOL SERIES: 221-242

1026-2135 AUDIO OSCILLATOR BOARD SYMBOL SERIES 243 249

1026-2725 MODULATOR BOARD SYMBOL SERIES 301-329

1026-2745 PULSE STRETCHER BOARD SYMBOL SERIES 331-359

ELEMENTARY SCHEMATIC DIAGRAM OF PANEL ASM

ELEMENTARY SCHEMATIC DIAGRAM OF RADIO FREQ. ASM.

NOTE UNLESS SPECIFIED

1. POSITION OF ROTARY SWITCHES SHOWN COUNTERCLOCKWISE.
2. CONTACT NUMBERING OF SWITCHES EXPLAINED ON SEPARATE SHEET SUPPLIED IN INSTRUCTION BOOK.
3. REFER TO SERVICE NOTES IN INSTRUCTION BOOK FOR VOLTAGES APPEARING ON DIAGRAM.
4. RESISTORS 1/2 WATT.
5. RESISTANCE IN OHMS K - 1000 OHMS M - 1 MEGOHM
6. CAPACITANCE VALUES ONE AND OVER IN MICROFARADS. LESS THAN ONE IN MICROFARADS.
7. ◯ KNOB CONTROL
8. ⊘ SCREWDRIVER CONTROL
9. AT - ANCHOR TERMINAL
10. TP - TEST POINT

DIAGRAM CROSS REFERENCE LIST

NAME OF DIAGRAM	DWG NO.
RADIO FREQUENCY SCHEMATIC	1026-2DA
MODULAR SCHEMATIC	1026-2DB
PANEL SCHEMATIC	1026-2DC
OVERALL BLOCK DIAGRAM	1026-2DE

Figure 6-4.

SCHEMATIC DIAGRAM OF 1026-A POWER SUPPLY ASM.

FOR L501 CONNECTIONS:
115V. OPERATION CONNECT "1 TO "3 ; "2 TO "4
230V. OPERATION CONNECT "2 TO "3
FOR L502 CONNECTIONS:
115V. OPERATION CONNECT "1 TO "3 ; "2 TO "4 ; "5 TO "7 ; "6 TO "8
230V. OPERATION CONNECT "2 TO "3 ; "6 TO "7
FOR T501 CONNECTIONS:
115V. OPERATION CONNECT "1 TO "3 ; "2 TO "4 ; "4 TO "6 ; "5 TO "7
230V. OPERATION CONNECT "2 TO "3 ; "5 TO "6

PL516
105-125V.
L501
T501
L502B
L502A
CR502
CR501
CR503
CR504
Q501
R503 4.7
CR505 10V
R501 470
R504 680
R505 200 HEATER VOLTAGE ADJ
R502 10K
C501 120μF
R506 360
C502A,B 400μF
18V.
R509 120
CR510
CR511
R507 30
CR506
CR507
CR508
CR509
180V.
WH-VT-BL
WH-VT-6N
40V.
WH-OR
WH-VT
WH-6Y
WH-BL
85V.
WH-VE
WH-GN-BK
WH-GN-BL
R508 2.4 2W
CR512
CR513
CR514
CR515
26V.
WH-VT-RD
WH-VT-6Y
C503A,B,C 900μF
R510 11
CR516
CR517
CR518
CR519
13V.
WH-6Y-BL
WH-6Y-6N
C504A,B,C 3000μF
14.5V.
6.6V.
WH-6Y-RD
WH-RD-BL
30V.
WH-RD-BK
WH-RD-6N
WH-RD-BK

REGULATOR
TERM. NOS: 01-06, 7, 8

+265V
R531 68 5W
R533 68 5W
R535 68 5W
R532 75 2W
R532*
R536 75 2W
Q531
R537 220
Q532
R542 4.7K
R543 15
C535 0.1
R544 15K REGULATED VOLT. ADJUST
R545 10K 1/4W
C534 25μF
CR531 20V
R538 10K
R534 2.2K
R539 680
Q533
Q534
Q535
C533 .022
R540 51K 2W
R541 120K 1W
R547 100K
R548 36K
C536 0.22
C531A 60μF
C531B 50μF
C531C 50μF
C532A 60μF
C532B 50μF
C532C 50μF
R549 1.2K 5W
R550 1.2K
C537A 15μF
C537B 15μF
R551 100K 1/4W MODULATOR OFFSET VOLTAGE ADJUST
(TO UNTUNED BUS) +220
(TO MODULATOR) +200
(TO OSCILLATOR) +200
GND
GND
+30
GND
-12.4
-6.3
R518 4Ω 5W
TP530 AC HTR
PL530
+250
+265
+220
+200
+200
GND
GND
+30
GND
-12.4
-6.3

+35V
R560 2.4 2W
Q560
R561 56
Q561
R562 220
R563 220
R564 100K 1W
C560A,B,C 800μF
C561 25μF
CR560 30V

R570 1 2W
Q570
R571 27
Q571
R573 27K
R575 12K
-12.4 V ADJ
R576 2.5K 1/4W
Q573
Q572
R572 91
R574 150
CR570 10V
R577 10K
C570A,B,C 3000μF
C571 0.47
C572 0.1

Q532, 533, 535 — Q534, 573 — Q501, 561, 571, 572 — Q531, 560, 570

TRANSISTORS - BOTTOM VIEW

* VALUE SELECTED BY LAB. IN RANGE FROM 330K TO 560K

NOTE UNLESS SPECIFIED

1. POSITION OF ROTARY SWITCHES SHOWN COUNTERCLOCKWISE.
2. CONTACT NUMBERING OF SWITCHES EXPLAINED ON SEPARATE SHEET SUPPLIED IN INSTRUCTION BOOK.
3. REFER TO SERVICE NOTES IN INSTRUCTION BOOK FOR VOLTAGES APPEARING ON DIAGRAM.
4. RESISTORS 1/2 WATT.
5. RESISTANCE IN OHMS K - 1000 OHMS M - 1 MEGOHM
6. CAPACITANCE VALUES ONE AND OVER IN PICOFARADS. LESS THAN ONE IN MICROFARADS.
7. ◯ KNOB CONTROL
8. ⊘ SCREWDRIVER CONTROL
9. AT ANCHOR TERMINAL
10. TP TEST POINT

Figure 6-5. SCHEMATIC DIAGRAM OF 1026-A PANEL ASSEMBLY

RADIO FREQUENCY ASSEMBLY FOR SCHEMATIC DIAGRAM SEE 1026-2DA

POWER SUPPLY FOR SCHEMATIC DIAGRAM SEE 1026-2DD

CABINET

MODULATOR ASSEMBLY FOR SCHEMATIC DIAGRAM SEE 1026-2DB

AUDIO AMPLIFIER & CRYSTAL CALIBRATOR SWITCH ASSEMBLY
TERM NOS.: 411-423

ANCHOR TERM NOS: 401, 402, 403

TRANSISTOR OUTLINE (BOTTOM VIEW)

Q411, 412, 413

S400 & S420

DIAGRAM CROSS REFERENCE LIST	
NAME OF DIAGRAM	DRAWING NUMBER
RADIO FREQ. SCHEMATIC	1026-2DA
MODULATOR SCHEMATIC	1026-2DB
POWER SUPPLY SCHEMATIC	1026-2DD
OVERALL BLOCK DIAGRAM	1026-2DE